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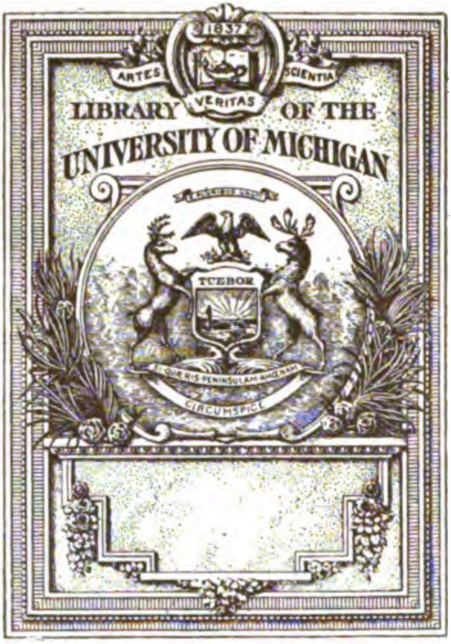

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REVIEW

—OF—

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REVIEWERS.

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REVIEW OF AMERICAN CHEMICAL RESEARCH.[1]

Vol. III. No. 1.

Arthur A. Noyes, Editor; Henry P. Talbot, Associate Editor.

Reviewers: Analytical Chemistry, H. P. Talbot; Biological Chemistry, W. R. Whitney; Carbohydrates, G. W. Rolfe; General Chemistry, A. A. Noyes; Geological and Mineralogical Chemistry, W. O. Crosby; Inorganic Chemistry, Henry Fay; Metallurgical Chemistry and Assaying, H. O. Hofman; Organic Chemistry, J. F. Norris; Physical Chemistry, H. M. Goodwin; Sanitary Chemistry, E. H. Richards; Technical Chemistry, A. H. Gill and F. H. Thorp.

INORGANIC CHEMISTRY.

By Henry Fay, Reviewer.

On the Diffusion of Sulphides through Steel. By E. D. Campbell. *Am. Chem. J.*, 18, 707–719.—In a previous paper (*Am. Inst. Min. Eng.*, 23, 621), the author has described the rapidity with which sulphide of iron diffused through steel at a bright red heat. Bars of soft steel of the dimensions 2.5 × 5 × 15 cm., and the ordinary fused sulphide of iron were used. Holes 12 mm. in diameter and 30 mm. deep were filled with 10 grams iron sulphide, and an iron plug was driven in. After heating to a bright red heat in a muffle, the bar was allowed to cool slowly. The hole was then found nearly empty, and drillings taken near the hole showed on analysis no increase in sulphur, while the scale formed at the surface by oxidation showed 2.6 per cent. of sulphur. These experiments were taken up later, but a different specimen of iron sulphide was used. Though carried out in exactly the same manner, no diffusion was found to take place. A Hoskins muffle furnace was arranged so that the sulphide in the hole could be watched during the heating. Using the normal sulphide of iron, FeS, in both open and plugged holes, the sulphide was seen to melt, but no diffusion took place. A subsulphide, approximately of the composition, Fe_2S, was next made, and a bar 5 cm. long was prepared with two holes equally distant from the center and ends; each hole was filled with 12 grams of the sulphide. The bar was placed in the furnace on platinum covered supports, and heated to a bright red heat in an oxidizing atmosphere for about two hours. No diffusion was noticed. An oxysulphide of iron was then prepared and found to diffuse quite rapidly. In from 10–15 seconds from the time the sulphide was observed to begin diffusing, diffusion appeared to be complete and the greater part of the sulphur had been oxidized in the air at the temperature of the experiment. To show that the oxysulphide diffuses the whole length of the bar, a bar 10 cm. long was prepared, and a hole was drilled 12 mm. from the end. At the further end a strip of asbestos was placed, held in position by a wire passing around the bar. The temperature was brought to a bright red heat, and after cooling the portions of asbestos in contact with top and bottom were found black from oxide of iron, due to the complete diffusion. Cuprous sulphide was found not to diffuse at all, but mixed with oxysulphide of iron it was carried along with it. Nickel sulphide does not diffuse alone, nor when mixed with iron oxysulphide. The author explains the phenomenon by assuming that oxysulphide of iron is an extremely mobile liquid at the temperature of the experiment, and that steel is probably porous at the high temperature, so that diffusion can take place; the diffusing substance would readily be absorbed by any porous absorbent material, such as asbestos or scale. Cuprous sulphide he considers is not sufficiently mobile to be drawn through the fine pores of the steel. Gravity affects the diffusion, showing that the diffusion takes place in the liquid, and not in the gaseous state.

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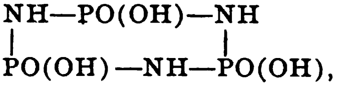
[1] This Review, which for two years past has appeared in the *Technology Quarterly* and as a separate publication, will hereafter be published only in this journal and in the *Technology Quarterly*. Copies of the two preceding volumes may be obtained by addressing the Librarian of the Massachusetts Institute of Technology, Boston, Mass.

On the Influence of Heat Treatment and Carbon upon the Solubility of Phosphorus in Steels. BY E. D. CAMPBELL AND S. C. BABCOCK. *Am. Chem. J.*, **18**, 719–723.—This work was undertaken to see whether heat treatment and carbon influence the solubility of phosphorus, and to determine whether chemical evidence could be obtained to prove the existence of phosphorus in steels in different modifications. For this purpose samples were taken containing varying percentages of carbon, and subjected to different heat treatments. The phosphorus was determined in each in an annealed sample, in a hardened one, and in a normal portion, as it came from the mill. In each sample a determination was made of the total phosphorus, of the phosphorus soluble and insoluble in neutral mercuric chloride, and of that insoluble in neutral mercuric chloride but soluble in 4 per cent. hydrochloric acid. The phosphorus soluble in mercuric chloride was determined by shaking 5 grams of steel with 35 grams of mercuric chloride and 130 cc. of water. The filtrate was examined for phosphorus by adding 10 cc. of ferric chloride solution, in which the phosphorus had been previously determined, and 4 grams sodium acetate, precipitating as basic acetate, dissolving and reprecipitating with ammonium molybdate. The portion insoluble in mercuric chloride was placed, together with the mercury, in a boat in a combustion tube, and after the mercury had been volatilized, the phosphorus was determined in the residue. From the table of results given, the following conclusions are drawn: 1. With very low percentage of carbon, the effect of heat treatment upon the solubility of phosphorus is slight. Probably if carbon were entirely absent there would be no effect. 2. With increase of carbon the effect of hardening is to decrease the solubility of the phosphorus. 3. With a high percentage of carbon the solubility is increased by slow cooling. The author considers that these facts indicate the probable formation at a high temperature of a difficultly soluble compound of iron with carbon and phosphorus, which on slow cooling passes into an easily soluble one.

A Pure Carbide of Iron. BY E. D. CAMPBELL. *Am. Chem. J.*, **18**, 836–847.—The investigation was undertaken to see whether a purer carbide of iron than any heretofore isolated could be obtained, and to determine whether a formula as simple as CFe_3 should be assigned to it. The steel used in the work was one containing 1.29 per cent. of carbon. It was cut into bars and the bars carefully annealed by packing between layers of sheet asbestos; below these was a layer of crushed charcoal, and above a mixture of one part of charcoal to five of wood ashes. The muffle in which the whole was placed, was brought to a bright red heat, the fires banked, and allowed to cool slowly. After cooling, the scale was removed by grinding on an emery wheel, and the bars were cut into strips 15 cm. long, 15 mm. wide, and 5 mm. thick. Twelve of these bars were hung on a ring of copper wire in a 4 per cent. solution of hydrochloric acid and connected with the positive pole of four storage batteries. The negative pole was a platinum cylinder suspended in a porous cup placed in the center of the circle of bars. A current of one ampere was allowed to act over night, and in the morning the residue adhering to the bars was removed with a brush of aluminum wires. The carbide was washed with potassium hydroxide and water, and the lighter portions decanted off. The carbide remaining was washed with alcohol and ether, the dried product consisting of a bright steel gray powder made up of thin plates or scales of specific gravity 6.944. After 29 electrolyses 575.8 grams of steel were dissolved and 55.1 grams of carbide obtained. On analysis the substance gave 6.646 and 6.625 per cent. carbon, 93.25 per cent. iron, and 0.026 per cent. phosphorus. The carbide is slowly but completely converted into ferric oxide by oxidation in moist air, and is completely soluble in moderately concentrated hydrochloric acid. An examination of the gases evolved on treatment with acid showed them to be hydrogen, ethane, and the unsaturated hydrocarbon butylene, probably mixed with a little dibutylene. Butane probably remained in the solution in the generating flask. The author considers it not improbable that iron and carbon may form a series of ferrocarbons of the general formula C_nFe_{3n}, analogous to the hydrocarbons C_nH_{2n}, in which a group of three bivalent iron atoms would replace two hydrogen atoms of the unsaturated hydrocarbon. On treatment with acids the corresponding hydrocarbon would be set free, and would be partly converted into the corresponding saturated hydrocarbon by secondary reactions.

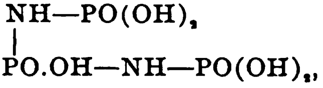
The Alkali Trihalides. By CHARLES H. HERTY AND HOMER V. BLACK. *Am. Chem. J.*, 18, 847–849.—It has been previously shown by Herty that the so-called compounds PbICl, $PbI_2.2PbCl_2$, and $PbI_2.5PbCl_2$ are isomorphous mixtures of lead iodide and lead chloride. To determine whether the alkali trihalides are of the same nature, rubidium dibromiodide was prepared by adding bromine to rubidium diiodide. On evaporation three separate crops of crystals, similar in appearance, were obtained, and each crop was analyzed, giving results which indicated that they were all of the same composition, namely, that represented by the formula $RbBr_2I$. They are therefore not isomorphous mixtures.

On Trimetaphosphimic Acid and Its Decomposition Products. By H. N. STOKES. *Am. Chem. J.*, 18, 629–663.—In a previous paper the author has shown that by shaking with water an ethereal solution of Liebig's phosphorus chloronitride, $P_3N_3Cl_6$, an acid is obtained which has the empirical formula $P_3N_3O_6H_6$, and to which he gave the name trimetaphosphimic acid. He regarded the acid as a metaphosphoric acid $(HPO_3)_n$, in which one-third of the oxygen is replaced by an equivalent number of imido (NH) groups. The acid is best prepared by agitating 30 grams of phosphorus chloronitride dissolved in 150 cc. alcohol-free ether with a solution of 110 grams of sodium acetate in 200 cc. of water. After 15 hours well formed crystals of the sodium salt appear, and after 70–80 hours the reaction is complete. The constitution of trimetaphosphimic acid depends upon that of the phosphorus chloronitride. The structural formula of the latter has not been definitely established, but it is reasonably certain that the phosphorus atoms are joined by nitrogen, otherwise the formation of hydrazine might be expected. It is quite likely, also, that chlorine is not united to nitrogen; for in this case hydroxylamine might be expected. The simplest formula meeting the requirements is one in which the nucleus consists of a symmetrical ring of three phosphorus and three nitrogen atoms. Direct replacement of chlorine would give an acid in which the grouping $-(OH)_2P=N-$ is repeated three times in the ring, but the author considers that the labile nature of the hydrogen, as observed in many organic substances containing nitrogen, makes it not improbable that the grouping may take the tautomeric form $-(OH)PO-NH$. This assumption is in accordance with the facts, and explains the formation and decomposition of trimetaphosphimic acid. The acid is extremely soluble, uncrystallizable, and undergoes rapid spontaneous decomposition. The final decomposition products are phosphoric acid and ammonia, but the intermediate products, diimidotriphosphoric acid, imidodiphosphoric acid, and pyrophosphoric acid have been isolated. Assuming the symmetrical ring formula referred to above:



$$\begin{array}{l}\mathrm{NH{-}PO(OH){-}NH}\\ \mid \qquad\qquad\qquad \mid\\ \mathrm{PO(OH){-}NH{-}PO(OH)},\end{array}$$

the decomposition with water takes place with the formation of ammonia and diimidotriphosphoric acid:

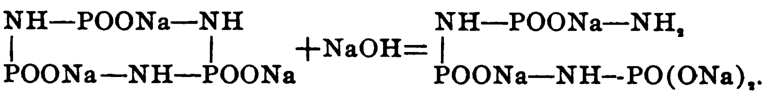


$$\begin{array}{l}\mathrm{NH{-}PO(OH)_2}\\ \mid\\ \mathrm{PO.OH{-}NH{-}PO(OH)_2},\end{array}$$

this again reacting with water to form ammonia and imidodiphosphoric acid: $\mathrm{NH}{<}\begin{smallmatrix}\mathrm{PO(OH)_2}\\ \mathrm{PO(OH)_2}\end{smallmatrix}$, and phosphoric acid. The imidodiphosphoric acid then reacts with water to form pyrophosphoric acid and ammonia; this reaction is shown to take place by heating the free acid with dilute acetic acid, when about 15 per cent. pyrophosphoric acid is obtained. The sodium salt of trimetaphosphimic acid, $P_3N_3O_6H_3Na_3.4H_2O$, was prepared by treating an ethereal solution of phosphorus chloronitride with sodium acetate. When crystallized above 80° C. it contains only one molecule of water. The ammonium salt,

$$P_3N_3O_6H_3(NH_4)_3.H_2O,$$

and the silver salt, $P_3N_3O_6H_4Ag_2$ are characteristic, and serve to identify the acid. The silver salt, $P_3N_3O_6Ag_6$ exists in two well defined forms. Its analysis serves to establish the empirical composition of the acid. One of these silver salts is white, amorphous, and soluble in ammonium nitrate, and is easily converted by this reagent into the other, which is red, crystalline, and insoluble in it. By crystallizing the tertiary sodium salt from an excess of sodium hydroxide a salt containing four atoms of sodium is obtained. The author considers it as an amido derivative of diimidotriphosphoric acid, assuming that sodium hydroxide is added directly to the molecule of the trisodium salt in this way:



$$\begin{array}{l}\mathrm{NH{-}POONa{-}NH}\\ \mid \qquad\qquad\qquad\; \mid\\ \mathrm{POONa{-}NH{-}POONa}\end{array} + \mathrm{NaOH} = \begin{array}{l}\mathrm{NH{-}POONa{-}NH_2}\\ \mid\\ \mathrm{POONa{-}NH{-}PO(ONa)_2}.\end{array}$$

Silver nitrate precipitates a salt from the tetra sodium salt, but it decomposes so readily that satisfactory analytical results could not be obtained. Diimidotriphosphoric acid forms two series of salts, in which three and five atoms, respectively, of hydrogen are replaced. The alkali salts with three atoms of metal are neutral; those with five atoms have an alkaline reaction. The two remaining hydrogen atoms have not been replaced by metal. Imidodiphosphamic acid is probably identical with Gladstone's pyrophosphamic acid. It forms a tri and a tetra silver salt, the latter existing in two distinct forms. The acid can be distinguished from amidodiimidotriphosphoric acid by the insolubility of its magnesium salt, by its syrupy tertiary sodium salt, and by the yellow precipitate which its ammoniacal solution gives with silver nitrate.

On Tetrametaphosphimic Acid. BY H. N. STOKES. *Am. Chem. J.*, **18**, 780–789.—Tetrametaphosphimic acid can be obtained by agitating tetraphosphonitrilic chloride, $P_4N_4Cl_8$, dissolved in 15 volumes of alcohol-free ether with five volumes of water. Chlorhydrines are formed as intermediate products, but remain dissolved in the ether, while the free acid separates in crystalline condition. From one of the chlorhydrines an acid was obtained, but in too small amount to determine its composition. Tetrametaphosphimic acid can also be obtained in the form of its ammonium salt by agitating the chloride with aqueous ammonia or ammonium acetate. In the latter case the yield is theoretical. The free acid crystallizes with two molecules of water, $P_4N_4O_8H_8.2H_2O$, which are not given off in vacuo. At 100° C. it loses weight at first rapidly, and then slowly, but the total loss never reaches the theoretical. Heated rapidly to 130–140° C. the loss is soon replaced by a gain, and after 30 hours at this temperature an increase of 11.15 per cent. was observed. The product consisted of unchanged acid, with ammonium phosphate and apparently pyrophosphoric acid. One hundred parts of water at 20° C. dissolve 0.64 parts of the crystallized acid. Boiling alkaline solutions cause no evolution of ammonia. It is extremely stable towards acids. Experimental data are lacking for a discussion of the constitution of this acid, as the decomposition products are extremely unstable. Presumably the phosphorus atoms in the nucleus P_4N_4 are united by nitrogen atoms, but whether they constitute a ring of eight atoms cannot be decided. Three series of salts are formed, $P_4N_4O_8H_6M'_2$, $P_4N_4O_8H_4M'_4$, and $P_4N_4O_8M'_8$. The dipotassium, tetrasodium, di- and tetra-ammonium, dibarium, and tetrasilver salts are described. If an ammoniacal solution of a salt containing four atoms of metal is added to an excess of silver nitrate, a yellow flocculent precipitate forms which is insoluble in ammonium nitrate. When, however, a neutral tetrametaphosphimate is added to silver nitrate containing a slight excess of ammonia, a small amount of a nearly white flocculent precipitate forms which is soluble in ammonium nitrate on gently warming; from this solution an orange yellow crystalline substance is thrown out on boiling for a moment. From the original filtrate a large quantity of the same salt is obtained by boiling. Each salt contains eight atoms of silver, and the crystalline salt is apparently a modification of the yellow precipitate formed in the first case. The author suggests that these salts may be regarded as corresponding to the tautomeric forms of the acid $(PN(OH)_2)_4$ and $(PO.NH.OH)_4$.

Mercuric Chlorthiocyanate. By CHARLES H. HERTY AND J. G. SMITH. *J. Am. Chem. Soc.*, 18, 906–908.—By fractional crystallization and analysis of the different crops of crystals, the authors conclude that mercuric chlorthiocyanate is a true chemical compound, and not an isomorphous mixture of mercuric chloride and mercuric thiocyanate.

Nickelo-Nickelic Hydrate, $Ni_3O_4.2H_2O$. By WILLIAM L. DUDLEY. *J. Am. Chem. Soc.*, 18, 901–903.—Nickelo-nickelic hydrate, $Ni_3O_4.2H_2O$, was obtained in crystals by fusing metallic nickel with sodium peroxide.

Contribution to the Knowledge of the Ruthenocyanides. By JAMES LEWIS HOWE. *J. Am. Chem. Soc.*, 10, 981–987.—The author has tried many methods for the preparation of ruthenocyanide to ascertain the efficiency of each, has given some qualitative reactions, and has prepared and analyzed the potassium and barium salts.

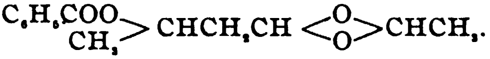
Some New Compounds of Thallium. By L. M. DENNIS AND MARTHA DOAN, **with Crystallographic Notes,** BY A. C. GILL. *J. Am. Chem. Soc.*, 18, 970–977.—The authors have prepared the compounds thallous trinitride, TlN_3, thallous-thallic trinitride, $TlN_3.TlN_9$, thallous tellurate, Tl_2TeO_4, and thallous cyanplatinite, $TlPt(CN)_4$. The author calls the acid HN_3 hydronitric acid and its salts trinitrides. Owing to the fact that other nitrides besides those derived from this acid exist, it is far preferable in the reviewer's opinion to name the acid *hydrazoic acid*, in accordance with the proposal of its discoverer, and to call its salts *azides*.

Reduction of Concentrated Sulphuric Acid by Copper. By CHARLES BASKERVILLE. *J. Am. Chem. Soc.*, 18, 942–947.—The author refutes the statement of Andrews (*this Rev.*, 2, 6,) that copper is not acted upon at 0° C., and not until 86° C. has been reached, which is above the point of dissociation of sulphuric acid. The previous work of the author has been repeated and confirmed. He also shows that, when air is absent, sulphuric acid is reduced by copper at a temperature far below 86° C. with formation of cupric sulphate, cuprous sulphide and sulphur dioxide.

ORGANIC CHEMISTRY.

J. F. Norris, Reviewer.

The Action of Sodium on Aldehyde. By Paul C. Freer. *Am. Chem. J.*, 18, 552–562.—When aldehyde, diluted with ether, was treated with sodium, hydrogen was evolved and a white crystalline sodium derivative, believed to have the structure $CH_2 : CHONa$, was formed. The compound could not be analyzed, as it soon changed into a brown, sticky mass. Sodium reacted with an ethereal solution of aldehyde and benzoyl chloride. After the reaction was completed, the solvent was washed with potassium hydroxide to remove benzoic acid, dried, and evaporated in a vacuum. A thick, slightly yellow syrup, which soon became permeated with a mass of prismatic crystals, was obtained. The latter melted at 86°–87°, had the composition $C_{13}H_{16}O_4$, and were soluble in alcohol, ligroïn, benzene, and chloroform. By treatment with water at 100° in a closed tube, the compound was decomposed into benzoic acid, aldol, and aldehyde. Destructive distillation, decomposition at 100° with hydrochloric acid, and heating the pure compound at 150° in a sealed tube, yielded, in each case, the same products: benzoic acid, crotonic aldehyde, and acetic aldehyde. When warmed with alkali, solution takes place and aldehyde resin is formed. The compound does not react with dilute alkalies, bromine, cold potassium permanganate, or phenylhydrazine. From the behavior of the compound, the author concludes that it is aldehydo-aldolbenzoate,



$$\begin{matrix}C_6H_5COO\\ CH_3\end{matrix}\!> CHCH_2CH <\!\begin{matrix}O\\ O\end{matrix}\!> CHCH_3.$$

In the preparation of the substance, sodium acetaldehyde, which is first formed, condenses to a derivative of aldol, which, in turn, reacts with the benzoyl chloride present. As the benzoyl group in the resulting compound is joined to oxygen, the structure of sodium acetaldehyde is $CH_2 : CHONa$. The liquid product of the action of sodium on aldehyde and benzoyl chloride was shown to be aldol benzoate by comparing its behavior, when subjected to destructive distillation, with that of a similar compound prepared from aldol, benzoyl chloride, and sodium.

On the Constitution of Some Derivatives of Formic Acid. By Paul C. Freer and P. L. Sherman, Jr. *Am. Chem. J.*, 18, 562–584.—As the physical and chemical properties of formic acid are not in accord with the constitutional formula assigned to it, the authors undertook an investigation of formylphenylhydrazine, formamide, and formic ester, in order to throw some light on the structure of the formyl group —CHO. When formylphenylhydrazine was dissolved in a concentrated alcoholic solution of sodium ethylate and the solution diluted with ether, a mono-sodium salt crystallized out. To determine the position of the sodium atom, the substance was treated with ethyl iodide under different conditions. When suspended in dry ether, monoethylformylphenylhydrazine was obtained, which melted at 106° and crystallized in rhombohedra. As the compound was not saponified by sodium hydroxide, and its reduction products were aniline and ethylamine, it follows that its structure is $C_6H_5NH—N(C_2H_5)—CHO$. It did not react with ethyl iodide and sodium ethylate or with sodium. When the sodium salt of formylphenylhydrazine was dissolved in absolute alcohol, a monoethyl derivative, melting at 78°–79°, and crystallizing in needles, was obtained. Its constitution, as shown by its reduction-products, unsymmetrical ethylphenylhydrazine, ethylaniline, and ammonia, is $C_6H_5NC_2H_5—NH—CHO$. When treated with ethyl iodide and sodium ethylate, diethylformylphenylhydrazine was formed. The latter compound did not react with sodium, and gave as reduction-products ethylamine and ethyl aniline. The formation of the two mono-ethyl derivatives excludes the possibility that the sodium atom is attached to oxygen because, were addition of ethyl iodide to take place at the unsaturated nitrogen-linking, with a subsequent splitting off of sodium iodide or hydriodic acid, but one ethyl derivative, with the structure $C_6H_5NH—NC_2H_5—CHO$, could be obtained. Acetic anhydride reacted with formylphenylhydrazine, forming a compound in which the acetyl group was joined to nitrogen. Benzoyl chloride and sodium ethylate gave a mono- and dibenzoylformylphenylhydrazine. The sodium derivative of the latter was prepared. Chlorcarbonic ester and formanilide reacted with the formation of ethylisoformanilide, $C_6H_5N = CHO.C_2H_5$, and diphenylformamidine, $C_6H_5N = CH—NH—C_6H_5$. Sodium reacted with formic ester in the cold, yielding hydrogen, carbon monoxide, and sodium ethylate. When amyl formate was used, the reaction was slower; sodium amyl formate was first formed and then broke down. The authors conclude that the above reactions prove that the sodium in sodium formylphenylhydrazine is attached to nitrogen and that, therefore, no hydroxyl group is present. They do not furnish any evidence of the presence of an aldehyde group and, consequently, a structural formula according to the present theories is not possible. On the other hand, there is evidence of a hydroxyl grouping in the salts of formanilide. No explanation can be given of the fact that diethylformylphenylhydrazine, in which there is a grouping similar to that in formic ester, does not react with sodium, whereas the ester reacts with sodium readily.

On Certain Derivatives of Trichlordinitrobenzol. BY C. LORING JACKSON AND W. R. LAMAR. *Am. Chem. J.*, 18, 664–

685.—For several years the behavior of tribromdinitrobenzene, melting at 192°, with various reagents, has been studied by Jackson and his pupils. The action of the analogous chlorine derivative with aniline, sodium ethylate, and sodium malonic ester is described in the present paper. When heated with aniline, trichlordinitrobenzene, melting at 129°.5, gives the same trianilidodinitrobenzene which was obtained from tribromdinitrobenzene. With sodium ethylate in the cold, trichlordinitrobenzene lost two of its atoms of chlorine, which were replaced by two ethoxy groups, forming chlordinitroresorcine diethyl ether, which melts at 160°. The reaction is analogous to that with the bromine derivative. A hot solution of sodium ethylate changed tribromdinitrobenzene into dinitroresorcine diethyl ether, while, under the same conditions, the chlorine compound was converted into a mixture of dinitrophloroglucine triethyl ether, $C_6H(NO_2)_2(OC_2H_5)_3$, which melts at 104°–105°, and its diethyl ether, $C_6H(NO_2)_2(OC_2H_5)_2OH$, melting at 166°. When treated with sodium malonic ester, two bromine atoms are removed and bromdinitrophenylmalonic ester,

$$C_6H_2Br(NO_2)_2CH(COOC_2H_5)_2,$$

is formed. Trichlordinitrobenzene gives with the same reagent dichlordinitrophenylmalonic ester,

$$C_6HCl_2(NO_2)_2CH(COOC_2H_5)_2.$$

Both substituted malonic esters are saponified by boiling with sulphuric acid, forming the corresponding phenylacetic acids, but the dichlordinitrophenylacetic acid,

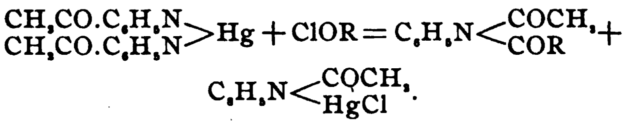
$$C_6HCl_2(NO_2)_2CH_2COOH,$$

differs from the bromdinitrophenylacetic acid in that the latter is so unstable that five crystallizations from alcohol convert it into bromdinitrotoluene, whereas the former can be crystallized from water without change. When boiled some hours with alcohol, dichlordinitrophenylacetic acid is converted into its ethyl ester. Both substituted malonic esters give red sodium salts, and are converted into nitrites by the action of nitric acid. Bromdinitrophenylacetic acid gives an intense green coloration with sodium hydroxide. Dichlordinitrophenylacetic acid is changed by the same reagent to a red compound, which soon fades to white.

Camphoric Acid. By W. A. Noyes. *Am. Chem. J.*, 18, 685–692.—In this paper, the fourth contributed by the author on the subject of camphoric acid, evidence is brought forward which disproves the formula of camphor proposed by Tiemann. In a previous paper (*Am. Chem. J.*, 17, 421), several reasons were given for believing that camphoric acid is a derivative of succinic rather than glutaric acid. This opinion has received additional support from the work described in the present paper, and it follows, therefore, that Bredt's formula for camphor is also incorrect. As it has been shown by the author (*loc. cit.*) that dihydrohydroxycampholytic acid contains a tertiary hydroxyl group, it follows that the carboxyl of aminolauronic acid is also tertiary. Independent investigations of Walker (*J. Chem. Soc.*, **63**, 506) and the author (*Am. Chem. J.*, **16**, 509; and *loc. cit.*) prove that the carboxyl in dihydroaminocampholytic acid is secondary. There should, accordingly, be a marked difference in the rate of esterification of the two acids. Ten times as much ester was obtained from the latter as from the former. The result disproves Tiemann's formula, for according to it the rate of esterification should be identical in both cases. The ethyl ester of aminolauronic acid is a mobile, strongly basic liquid with an ammoniacal, aromatic odor, and forms a sulphate difficultly soluble in water, which crystallizes in pearly-white plates. When the sulphate of the ester of aminolauronic acid is treated with a strong solution of sodium nitrite, it is decomposed with the formation of the ethyl ester of γ-lauronic acid and a small amount of the ester of a new hydroxylauronic acid. The two acids are separated by distillation with steam, after saponification of the esters. The hydroxy acid, which is non-volatile, is extracted with ether and is left, after evaporation of the solvent, as a viscous, hygroscopic liquid, which forms an insoluble copper salt, $\left(C_8H_{14}<\begin{matrix}CO_2\\OH\end{matrix}\right)_2Cu + H_2O$. The acid was shown to have a secondary hydroxyl group by the action of Beckmann's chromic acid mixture, which transformed it into the β-ketonic acid, which immediately decomposed into a ketone and carbon dioxide. Dihydro-cis-campholytic acid was prepared by reducing cis-campholytic acid with amyl alcohol and sodium. It melts at 244°, has the specific gravity 0.9833 at 20°, and is stable toward a cold solution of potassium permanganate. The amide melts at 161°. α-bromdihydro-cis-campholytic acid was prepared by treating the acid with phosphorus pentachloride and bromine. It melts at 129°–130°, and when treated with cold alcoholic potash, hydrobromic acid is removed and cis-campholytic acid is regenerated. This furnishes a new proof that the double union of cis-campholytic acid is in the α-β position and gives additional support to the view that the two campholytic acids are stereoisomers. Attempts to reduce the cis-trans-campholytic acid were unsuccessful. According to Armstrong's formula for camphor, cis-campholytic acid must be Δ^1-tetrahydroxylylic acid. The reduction of xylylic acid, $C_6H_3(CH_3)_2(1, 3)COOH(4)$, would give four stereoisomers, corresponding to which there would be four α-bromhexahydroxylylic acids. Two of these, supposing Armstrong's formula to be correct, would give ciscampholytic acid when treated with alcoholic potash ; and two would give either cis-trans-campholytic acid or Δ^6-tetrahydroxylylic acid. From the hexahydro acid, obtained by the reduction of xylylic acid, the α-brom derivative was prepared and, on treatment with alcoholic potash, did not yield any of the above products. The formula of Armstrong cannot, therefore, be the correct one.

Derivatives of Dihydro-cis-campholytic Acid. BY E. B. HARRIS. *Am. Chem. J.*, **18**, 692–695.—From the amide of dihydro-cis-campholytic acid prepared by Noyes (see preceding abstract), an amine, $C_8H_{15}NH_2$, was prepared by the action of potassium hypobromite. It is slightly soluble in water, boils at 156°.5, and has the specific gravity 0.8431 at 20°. The chloride, sulphate, and chlorplatinate are described. In order to obtain the alcohol corresponding to the amine, the latter was converted into the sulphate and treated with sodium nitrite. The greenish-yellow oil obtained was separated by distillation with steam into an oil which boiled at 122°, probably the hydrocarbon C_8H_{14} ; a small quantity of a white crystalline substance, which was not identified; and an oil which contained the alcohol $C_8H_{15}OH$. The latter was treated with Beckmann's mixture of sulphuric acid and potassium bichromate and the resulting ketone, after purification, converted into the oxime, which melted at 112°-113°. The properties of the oxime agree closely with those of the one prepared by Kipping (*J. Chem. Soc.*, **67**, 357) from dimethyl—(1, 3)—cyclohexenone—(2). If the oximes are identical, campholytic acid is Δ^1-tetrahydro—(1,2,3)—xylylic acid.

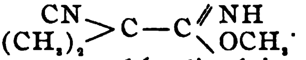
On Diacid Anilides. BY H. L. WHEELER. *Am. Chem J.*, **18**, 695–703.—In recent papers (*Am. Chem. J.*, **18**, 381 ; **18**, 540) the author has shown that by the action of benzoyl chloride on the silver and mercury salts of the anilides, mixed diacid anilides can be obtained. In the present paper it is shown that the action of aliphatic chlorides is analogous to that of benzoyl chloride, and that the resulting diacid anilides react with alkali with the separation of the lower acid radical and the formation of the anilide of the higher acid. From this reaction it appears that the diacid anilides are nitrogen derivatives. The method of preparation was as follows : Silver formanilide or mercury acetamide was suspended in dry ether or benzene and one molecular proportion of acid chloride added. The action began immediately and was complete, in the case of the lower acid chlorides, in a few minutes. After filtering from the silver chloride or the halogen mercuric compound, the filtrates were shaken with water, and on evaporation of the solvent the diacid anilides were obtained as oils, which were purified by fractionation under diminished pressure. The reaction is as follows :



$$\begin{matrix}CH_3CO.C_6H_5N\\CH_3CO.C_6H_5N\end{matrix}>Hg + ClOR = C_6H_5N<\begin{matrix}COCH_3\\COR\end{matrix} + C_6H_5N<\begin{matrix}COCH_3\\HgCl\end{matrix}.$$

The following compounds were prepared: Acetylacetanilide, formylacetanilide, formylpropionanilide, formyl-*n*-butyranilide, formylstearanilide, acetylpropionanilide, acetyl-*n*-butyranilide, acetylisovaleranilide, and acetylpalmitanilide. Formylpropionanilide and formylstearanilide are easily decomposed by heat, the former giving propionanilide, and the latter phenylisocyanide and stearic acid. Diacid amides are not formed by the action of acid chlorides on benzamide, the chief product being benzonitrile. From this fact it follows that different structures must be assigned to amides and anilides, if the action of acid chlorides is a direct double decomposition in both cases. The author suggests the possibility of the formation of unstable addition-products in one case, which break down into simple bodies.

On Malonic Nitrile and Some of its Derivatives. By B. C. Hesse. *Am. Chem. J.*, **18**, 723–751.—In order to determine whether the metal is joined to nitrogen or to carbon in the salts of malonic nitrile, the silver and sodium derivatives were prepared and their reactions with a number of reagents studied. Dry cyanacetamide, suspended in ether, does not react with sodium unless alcohol is present, when the mono-sodium salt is obtained. Dibromcyanacetamide is found by the action of one molecular proportion of bromine on cyanacetamide in aqueous solution. Malonic nitrile was prepared by fractionating the product obtained by heating equal weights of phosphorus pentachloride and cyanacetamide at 90° until the evolution of hydrochloric acid ceased. It is a white, ice-like solid, which melts at 29° and boils at 219°–220°. By the action of bromine on malonic nitrile, fused or in aqueous solution, a mixture of oils and amorphous and crystalline solids is produced. The latter bodies alone were studied, and proved to be the brom- and dibromderivatives of the nitrile. Brommalonic nitrile melts at 65°–66° and does not form a nitro compound with silver nitrite. Dibrommalonic nitrile melts at 123°.5–124°. The silver salt, formed by precipitating a cold aqueous solution of malonic nitrile (one molecule) with a cold solution of ammoniacal silver nitrate (two molecules), is a mixture of the mono- and disilver derivatives. This mixture gives with ethyl iodide, besides amorphous substances, diethyl malonic nitrile and ethyl isocyanide. The formation of the latter bodies is best explained if the structure assigned to the silver salt is AgN : C : C : C : NAg. The addition of alkyl iodide to the double bonds between the carbon atoms and subsequent elimination of silver iodide would give dialkyl malonic nitrile. The formation of an isocyanide is explained by the direct replacement of the silver by alkyl. The fact that no isocyanide is formed when the sodium salt of malonic nitrile is used is in accord with the above structure, as it is well known that sodium salts do not act by direct replacement as readily as silver salts. A mixture, probably of sodium malonic nitrile and sodium ethylate, was obtained in an attempt to prepare a disodium derivative of the nitrile. With methyl and ethyl iodides this mixture gave, when heated in sealed tubes for eight hours at 100°, dimethyl and diethyl malonic nitrile, melting at 32° and 44°, respectively. By the action of sodium ethylate on a mixture of malonic nitrile and ethyl chlorformate, sodium dicyanacetic acid ethyl ester was prepared. Malonic nitrile, sodium methylate, and methyl iodide gave a mixture of dimethyl malonic nitrile and dimethyl cyanacetimidomethyl ether,



$\begin{matrix}CN\\(CH_3)_2\end{matrix}\!>C-C\begin{matrix}/\!\!/ NH\\ \searrow OCH_3\end{matrix}$. The presence of the latter compound was proved by dissolving the mixture in water and precipitating methyl dimethylcyanacetate, $\begin{matrix}(CH_3)_2\\CN\end{matrix}\!>C.COOCH_3$, with hydrochloric acid. Analogous ethyl compounds were prepared. Diethylcyanacetamide, $\begin{matrix}(C_2H_5)_2\\CN\end{matrix}\!>C.CONH_2$, was formed in the preparation of diethylmalonic nitrile, and when the latter compound was boiled with absolute alcohol containing 1.3 per cent. of sodium. Diethylcyanacetic acid was prepared from the amide and, when heated in concentrated hydrochloric acid in a sealed tube at 160° for eight hours, was transformed into diethylacetic acid.

On the "Bechmann Rearrangement." BY JULIUS STIEGLITZ. *Am. Chem. J.*, **18**, 751–762.—The author offers the following explanation of the transformation of acid bromamides into isocyanates in the presence of an alkali. The alkali causes a direct loss of hydrobromic acid, producing the body RCO.N< with a univalent nitrogen atom, whose reactivity is great enough to take away the alkyl group from the carbon atom. The fact that acid dibromamides, $RCO.NBr_2$, chloranilides, and analogous bodies, RCO.NClR, do not suffer a similar rearrangement with alkali is in accord with this view. A number of the reactions of the acid azides $RCO.N\!<\!\begin{matrix}N\\ \|\\ N\end{matrix}$, can be explained in the same way. Two atoms of nitrogen are liberated, leaving the group RCO.N<, which suffers a molecular rearrangement, forming an isocyanate. In the presence of reducing agents in alkaline solution, two groups might unite forming diacyl, RCO.N = N.COR, which, by taking up two hydrogen atoms, would give the diacylhydrazine RCONH.NHCOR actually obtained. When reduced in acid solution, two atoms of hydrogen are added to the unsaturated group, $RCO.N<$, forming an acid amide. As it has not been determined whether the salts of the acid bromamides, which are formed before the transformation to the isocyanate takes place, have the structure RC(NBr)OMe or RCO(NBrMe), the author has investigated a number of compounds with analogous composition having alkyl groups in place of the metallic atoms. No rearrangement has been observed. Chlorimidoethylbenzoate, $C_6H_5C(NCl)OC_2H_5$, prepared by the action of sodium hypochlorite and hypochlorous acid on benzimidoethylether hydrochloride, is a colorless oil, insoluble in water, which boils at 131°–132° at 16 mm. pressure. An alcoholic solution evolves chlorine with hydrochloric acid and nitrogen with ammonia. When chlorimidoethyl benzoate was heated, decomposition took place, with violent boiling, in part according to the equation,

$$C_6H_5C(NCl)OC_2H_5 = C_6H_5CN + ClOC_2H_5.$$

Benzamide and a trace of an aniline derivative were secondary products of the reaction. Bromimidoethyl benzoate was much less stable than the chlorine compound.

Menthene Nitrosochloride and Some of Its Derivatives. By W. O. Richtmann and Edward Kremers. *Am. Chem. J.*, **18**, 762–780.—Menthene, prepared by heating menthol with anhydrous copper sulphate for ten hours, after six fractionations, boiled from 165° to 169°. A 15 per cent. yield of the fraction boiling at 167°–167°.5 was obtained and had the specific gravity 0.8103 and the rotary power $[\alpha]_D = +29°.63$. Menthene nitrosochloride was prepared from the different fractions of the menthene and purified by fractional crystallization. Products were obtained which melted from 106° to 117° and whose rotary power varied from $-2°.408$ to $+16°.715$. The menthene nitrobenzylamine prepared from the different specimens of the nitrosochloride melted at 105°.5–106°.5, and was inactive. The purest sample of nitrosomenthene obtained, melted at 64°–65° and had the rotary power $-4°.683$. The ketone prepared from the nitrosomenthene boiled from 205° to 218°. The fraction boiling at 207°–208° was obtained to the extent of 40 per cent. and had the specific gravity 0.9163 and the rotary power $-1°.3189$. A sample of inactive nitrosomenthane gave a ketone which had the rotary power $+0°.4299$. By the action of hydrogen sulphide on an alcoholic solution of the ketone, a hydrosulphide, $C_{10}H_{18}O.2H_2S$, was formed. With phenylhydrazine, a very unstable hydrazone, which melts at 72°.5–73°, was obtained. The product obtained by reducing the ketone consisted mainly of unchanged ketone. By the dehydration of the alcohol $C_{10}H_{18}O$, a hydrocarbon was not obtained, but a compound which formed an oxime and a hydrosulphide.

On the Non-Existence of Two Orthophthalic Acids. By H.

L. WHEELER. *Am. Chem. J.*, **18**, 829–836.—W. T. Howe (*Am. Chem. J.*, **18**, 390) recently published an account of a new orthophthalic acid and a number of its derivatives. The author has endeavored, in a series of eight experiments, to obtain the new acid by following the directions given. In every case ordinary phthalic acid was obtained. The author further shows that the analyses of the aniline salts of the two acids, although they agree with one another and the calculated figures as given, do not agree with the true values. The analyses of the brucine salts do not agree with either the calculated values given or the true ones.

The Action of Sulphuric Acid on Anisol. BY W. B. SHOBER. *Am. Chem. J.*, **18**, 858–865.—Anisol was treated with sulphuric acid, the amount of acid, the temperature at which the mixture was heated, and the time of heating, varying with each experiment. In order to separate the resulting acids, they were transformed into amides. Anisoldisulphonic acid was formed in every case when the mixture was heated on the water-bath to 92°, the proportion of the acid increasing with the increase in the proportion of the sulphuric acid, and with the increase in the time of heating. It is not formed at a temperature of 125°. When 10 grams of anisol and 80 grams of sulphuric acid were heated at 91° for 30 minutes, 97.6 per cent. of the resulting amides was anisoldisulphonamide. Paranisolmonosulphonic acid was formed in every experiment, the amount decreasing with increase of temperature, time of heating, and excess of sulphuric acid. 80 grams of sulphuric acid and 40 grams of anisol, heated at 92° for 35 minutes, gave a mixture containing 91.6 per cent. paramide. Orthoanisolmonosulphuric acid was formed in greatest quantity when anisol and sulphuric acid reacted at ordinary temperatures. 54.6 grams of sulphuric acid and 28.1 grams of anisol yielded a mixture containing 12.5 per cent. of the orthoamide.

Dipyridine Methylene Iodide and the Non-Formation of the Corresponding Monopyridine Products. BY S. H. BAER AND A. B. PRESCOTT. *J. Am. Chem. Soc.*, **18**, 988–989.—Dipyridine methylene iodide, $C_5H_5N{<}\substack{CH_2\\ I\quad I}{>}NC_5H_5$, was prepared by boiling for one hour molecular proportions of pyridine and methylene iodide, diluted with an equal volume of alcohol. The compound crystallizes in yellow needles, which decompose at 220°, and is soluble in water and in hot alcohol, and insoluble in ether, chloroform, and benzene. Dipyridine methylene bromide was obtained by digesting pyridine and methylene bromide in a sealed tube for two weeks. It melts at 295° and crystallizes in colorless plates. It was impossible to make monopyridine products.

[Contribution from the Massachusetts Institute of Technology.]

REVIEW OF AMERICAN CHEMICAL RESEARCH.[1]

Vol. III. No. 2.

Arthur A. Noyes, Editor; Henry P. Talbot, Associate Editor.

Reviewers: Analytical Chemistry, H. P. Talbot; Biological Chemistry, W. R. Whitney; Carbohydrates, G. W. Rolfe; General Chemistry, A. A. Noyes; Geological and Mineralogical Chemistry, W. O. Crosby; Inorganic Chemistry, Henry Fay; Metallurgical Chemistry and Assaying, H. O. Hofman; Organic Chemistry, J. F. Norris; Physical Chemistry, H. M. Goodwin; Sanitary Chemistry, E. H. Richards; Technical Chemistry, A. H. Gill and F. H. Thorp.

GENERAL AND PHYSICAL CHEMISTRY.

A. A. Noyes, Reviewer.

Determination of Atomic Masses of Silver, Mercury and Cadmium by the Electrolytic Method. By Willett Lepley Hardin. *J. Am. Chem. Soc.*, 18, 990–1026.—All the successful determinations described in this article were made by electrolyzing in a platinum dish potassium cyanide solutions of weighed quantities of various salts of the three metals, and by weighing the amount of metal deposited. Separate series, each consisting of ten experiments, were made in this way with silver nitrate, acetate, and benzoate; mercuric chloride, bromide, and cyanide; cadmium chloride and bromide. The final values of the atomic weights so obtained are 107.928 for silver, 199.99 for mercury, and 112.05 for cadmium, in close agreement with the values derived by Clarke from the work of previous investigators (107.92, 200.0 and 111.93.)

The Atomic Weight of Nitrogen and Arsenic. By Joseph Gillingham Hibbs. *J. Am. Chem. Soc.*, 18, 1044–1050.—The author has determined the atomic weights of nitrogen and arsenic by passing hydrochloric acid gas over weighed quantities of potassium and sodium nitrates and over sodium pyroarsenate, and weighing the residual sodium chloride. The values obtained are 14.0117 and 74.916 respectively. Those selected as most probable by Clarke in his last year's report are 14.04 and 75.09.

Chemistry and Its Laws. By F. Wald. *J. Phys. Chem.*, 1, 21–33. As this article is by a foreign author, and as the substance of it has already appeared in a more extended form in a foreign journal (*Ztschr. phys. Chem.*, 18, 357), a reference to its title will answer the purposes of this review.

On Ternary Mixtures. BY WILDER D. BANCROFT. *J. Phys. Chem.*, 1, 34–50.—This article is a continuation of a previous one on the same subject (*see Tech. Quart.*, 8, 306). The author shows that the solubility of salts in mixtures of water and alcohol can be expressed by the equation: $(x+A)y^n = C$, in which x represents the quantity of alcohol, and y the quantity of the salt, in a definite quantity of water, and in which A, n and C are constants determined from the experiments themselves. He shows further that the solubility x of a salt in an aqueous solution containing the quantity y of another salt can be expressed by the equation: $(x+A)(y+B)^n = C$, an equation which contains *four empirical constants*. The reviewer has already pointed out (*Tech. Quart.*, 8, 306), that no physical significance whatever can be attached to such results, a fact which will be evident to any one acquainted with the properties of empirical equations; for, if the introduction of so many arbitrary constants be permitted, a great variety of mathematical functions could be found which would represent the experimental results with a practically equal degree of accuracy. The agreement is, in other words, almost a mathematical necessity, and is therefore no evidence of the correctness of the author's application of the mass-action law to the phenomenon in question.

Precipitation of Salts. BY H. A. BATHRICK. *J. Phys. Chem.*, 1, 157–169.—The author has determined the solubility of potassium, sodium and ammonium chlorides, and of potassium and sodium nitrates, in various mixtures of water and alcohol, and of the last two salts in mixtures of water and acetone. He shows that his own results and also those of Nicol on the solubility of salts in the presence of one another can be expressed by the formulas proposed by Bancroft. He also discusses the criticism of the reviewer (see preceding review), in regard to the use of so many arbitrary constants, and points out that one of them, A, has the same value for a definite salt, whatever be the other substance by which it is precipitated. But strangely enough, according to the author's own calculations, this statement is not correct. And, if it were, it is not to be doubted that the three remaining arbitrary constants would suffice to make almost any form of function express the results satisfactorily.

Solution and Fusion. BY WILDER D. BANCROFT. *J. Phys. Chem.*, 1, 137–148.—This article contains no new experimental data, but presents the opinions of the author on certain subjects related to those named in the title.

Nascent Hydrogen. BY R. FRANCHOT. *J. Phys. Chem.*, 1, 75–80.—The author finds that a neutral ferric sulphate solution is reduced by metallic zinc, cadmium and copper, and concludes that in acid solutions this direct reduction takes place simultaneously with that caused by the nascent hydrogen.

Speed of Esterification, as Compared with Theory. BY ROBERT B. WARDER. *J. Phys. Chem.*, 1, 149-156.—The author shows that the rate of esterification of alcohol and the three chloracetic acids, as determined by Lichty (*Tech. Quart.*, **8**, 99), does not conform to the requirements of the laws of mass-action in the form applicable to a reversible reaction of the second order, and he suggests four possible causes of the deviations.

H. M. GOODWIN, REVIEWER.

The Specific Heat of Metals. BY F. A. WATERMAN. *Phys. Rev.*, 4, 161-191.—The author has perfected Hesehus' method of determining specific heats, and shows by numerous examples that it is capable of a high degree of accuracy. In this method the calorimeter is placed in the bulb of an air thermometer with an attached manometer, and the rise of temperature, due to the introduction of the hot substance, is exactly compensated by the addition of ice-water drop by drop until the manometer registers the original pressure within the air thermometer. An electric heater is provided for heating the substance to any initial temperature. This swings over the calorimeter for the introduction of the hot substance through a trap in the bottom of the heater. Without moving the calorimeter, the ice-water reservoir may be swung around in place of the heater, for the final operation. The apparatus described seems a model of convenience. The metals used were of a high degree of purity. The following results (the mean of a number differing by less than 0.1 per cent.) of the mean specific heat between 100° and 20° were obtained: Bismuth, 0.03035; tin, 0.05453; aluminum, 0.021946; copper, 0.09471; gold, 0.03068; zinc, 0.09547. The article contains in addition a compilation of the literature, and the results of all the more reliable specific heat determinations by different investigators; also a table of the most probable values of the mean specific heat of the metals, the determinations by different methods and observers being carefully weighted and combined. From a chemical standpoint the article is of especial interest as a presentation of the most accurately determined atomic heat values, illustrating the degree of validity of the Principle of Dulong and Petit. The author adopts 6.24+ as the most probable average value of the atomic heat.

On the Viscosity of Mercury Vapor. BY A. A. NOYES AND H. M. GOODWIN. *Phys. Rev.*, 4, 207-217.—The authors have determined the relative weights of mercury vapor, carbon dioxide and hydrogen, which were transpired under like conditions of temperature, (that of boiling mercury, 357°) and of pressure difference through the same capillaries in equal times, from which the relative viscosity and relative cross-section of the molecules of these gases could be computed. Experiments made at different pressures conformed to O. E. Meyer's pressure formula completely. For the more reliable capillary (74 cm. long and 0.34 mm. internal diameter), the values found for the relative viscosity η were: $\eta_{Hg} : \eta_{CO_2} = 2.08$; $\eta_{Hg} : \eta_{H_2} = 4.04$; $\eta_{CO_2} : \eta_{H_2} = 1.94$. The corresponding values of the relative mean cross-sections q were: $q_{Hg} : q_{CO_2} = 1.02$; $q_{Hg} : q_{H_2} = 2.48$; that is, the mean cross-section of the monatomic mercury molecule is nearly the same as the tri-atomic carbon dioxide molecule, and 2.5 times greater than that of the hydrogen molecule. These results indicate that atoms and molecules are of the same order of magnitude, and therefore that the interatomic spaces within molecules are not large in comparison with the size of the atoms. Properties like viscosity which depend on the size or form of molecules are therefore not well adapted for distinguishing between monatomic and polyatomic molecules.

On the Specific Gravity and Electrical Conductivity of the Normal Solutions of Sodium and Potassium Hydroxides and Hydrochloric, Sulphuric, Nitric and Oxalic Acids. By E. H. Loomis. *Phys. Rev.*, 4, 252–255.—The following results were obtained by the usual pyknometer and conductivity methods for normal solutions, which had been prepared with special care as to the purity of the substances used:

Compound.	Sp. gr. $\frac{18°}{4°}$.	K.10^7.
NaOH	1.0418	148
KOH	1.0481	170
HCl	1.0165	279
HNO_3	1.0324	278
H_2SO_4	1.0306	183
$(COOH)_2$	1.0199	55

Note on the Theory of the Voltaic Cell. By H. M. Goodwin. *Phys. Rev.*, 4, 241–246.—This is a reply to certain criticisms of Mr. Bancroft of an article by the author on the theory of the voltaic cell and its application to the calculation of the solubility of depolarizers of electrodes of the second kind. The author shows by experiments that the electromotive force of elements of the form Zn, $0.1n ZnCl_2$, $0.1n ZnBr_2$, Zn is practically zero exactly as is required by Nernst's theory, according to which the potential difference between a metal and an electrolyte is primarily determined by the *kation* concentration of the solution and not by that of the anions. Mr. Bancroft predicted for cells of this type very considerable electromotive forces, because according to his views, the potential difference between a metal and electrolyte is primarily determined by the *anions*. Moreover, experiments on similar reversible cadmium cells demonstrate with what certainty one may predict results from the osmotic theory, when the kation concentration of the metals used as electrodes is known. Experiments made with the abnormally dissociated halogen salts of cadmium and its nitrate, completely confirmed the conclusion derived by other methods that the nitrate, chloride, bromide and iodide are very unequally dissociated with respect to the cadmium ion, the nitrate being the most, and the iodide the least dissociated.

On Irreversible Cells. BY A. E. TAYLOR. *J. Phys. Chem.*, 1, 1–21, 81–91.—This investigation is a continuation of that of Bancroft on the chemical potential of the metals. The author finds in the good agreement of independent measurements of the electromotive force of non-reversible cells, reason for accepting Bancroft's view that such cells are limiting cases of reversible cells and possess a definite electromotive force. Further experiments, however, force him to reverse the Bancroft radical opinions regarding the influence of the anion. The main conclusions of his paper are namely: first, that the potential difference between a metal and an electrolyte is *not* a function of the negative ion of the salt solution; and second, that in certain cases dropping mercury electrodes do not give correct values for the single potential differences measured by that method.

Purification of Water by Distillation. BY G. A. HULETT. *J. Phys. Chem.*, 1, 91–95.—The still used was an ordinary retort of two liters capacity with a platinum condenser so arranged that only the vapor condensed within this tube was collected. Water distilled with potassium permanganate gave after one-fourth had been rejected, a distillate of nearly constant conductivity of the value: $K \times 10^{10} = 0.77$. Ordinary distilled water first distilled from an acid solution of potassium bichromate, and afterwards from barium hydrate gave equally good if not better results: $K \times 10^{10} = 0.76–0.71$. It is also found that the quality of the water was independent of the *rate* of distillation when barium hydrate was employed. Free sulphuric acid should not be used as it passes over into the distillate.

Viscosity of Mixtures of Liquids. BY C. E. LINEBARGER. *Am. J. Sci.*, 152, 331–341.—Continuing his researches on the properties of mixtures of "Normal" liquids, the author has in this paper extended his experiments to their viscosity. Ostwald's well known form of apparatus was used and all measurements were made at 25°. Sixteen different mixtures were investigated, and in no case was a maximum of viscosity observed; the origin of the maximum observed by other investigators is to be sought in their use of associated liquids. In most mixtures investigated, the observed viscosities are less than those calculated by the rule of mixtures. In certain mixtures, however, as those of benzene, with toluene, carbon disulphide and chloroform the differences are less than the experimental errors.

The Spectra of Argon. BY JOHN TROWBRIDGE AND THEODORE WILLIAM RICHARDS. *Am. J. Sci.*, 153, 15–20.—With the unusual facilities for investigating vacuum tube spectra afforded by a Planté battery of 5000 cells, the authors have made some very interesting experiments on the conditions necessary for the production of the "red" and "blue" spectra of argon, with a sample furnished by Lord Rayleigh. It was found that with a tube of large capillary and 15 cm. in length containing argon under a pressure of one millimeter, 2000 volts were sufficient to produce the red glow, a very much lower potential than that (27,600 volts) estimated by Crookes. The introduction of a condenser and spark gap between the terminal of the Geissler tube caused the red glow to disappear, and the peculiar blue glow to take its place. The potential necessary was estimated at not over 2000 volts. By a number of other experiments it was shown that the blue glow is produced by an oscillatory discharge, while the red glow is the result of an unidirectional discharge. So sensitive is argon to electrical oscillations in this respect that the authors propose to call an argon tube fitted for the study of electrical waves, for which it seems peculiarly adapted, a talantoscope.

On the Hydrolysis of Ferric Chloride. BY H. M. GOODWIN. *Tech. Quart.*, 9, 254–271. The gradual change which a neutral ferric chloride solution undergoes when a concentrated solution is suddenly diluted, which is indicated by a gradual change in its color from a light yellow to a deep reddish brown, was investigated by measuring the simultaneous increase in the electrical conductivity (at 25° F. of solutions varying from 0.1 to 0.0001 molecular normal). The measurements showed: *First*, that the molecular conductivity of dilute solutions increases with the time. *Second*, that the rate of increase increases very rapidly with the dilution. *Third*, that the increase in the conductivity does not begin at once on dilution, but only after the lapse of a certain time. *Fourth*, that the time elapsing before the reaction apparently begins, increases very rapidly with the concentration; thus the reaction as indicated by change of color and increase of conductivity begins after about one minute for a 0.0006 normal solution, 15 minutes for a 0.0012 normal solution, 4 days for a 0.015 normal solution. *Fifth*, that the time required for the completion of the reaction increases enormously with the concentration; for example, it is 3 hours for a 0.0001 normal solution, but over a week for a six times stronger solution. And *sixth*, that the reaction when once started progresses slowly at first, then more and more rapidly up to a maximum, after which the velocity decreases, until a condition of equilibrium is finally reached. The explanation suggested to account for this remarkable behavior is that, on first diluting a ferric chloride solution, the hydrolytic reaction $\overset{+++}{Fe} + H_2O = \overset{++}{FeOH} + \overset{+}{H}$ instantly takes place, whereby the conductivity is increased by an amount proportional to the difference of the migration velocities of the hydrogen and ferric ions. This is in agreement with the fact that the initial conductivity increases more rapidly than can be accounted for by electrolytic dissociation alone. The subsequent progressive change of color and of the conductivity of the solution is due to the gradual formation of undissociated deeply colored colloidal hydrate, according to the reaction $x\overset{++}{FeOH} + x2\overset{-}{OH} = (FeO_3H_3)_x$. A calculation under this assumption of the true initial *hydrolytic* dissociation from a combination of conductivity and freezing-point determinations makes it probable that the hydrolytic dissociation increases very rapidly with the dilution, being about 2 per cent. for a 0.1 to 0.2 normal solution, and 90 per cent. for a 0.0015 normal solution.

The Freezing-Points of Dilute Aqueous Solutions, III. BY E. H. LOOMIS. *Phys. Rev.*, 4, 273–297.—In this paper the author has extended his well known work on freezing-points to solutions of the following compounds: LiCl, $CaCl_2$, $SeCl_2$, $SnCl_4$, HNO_3, KOH, NaOH, KH_2PO_4, Na_2HPO_4, $Na(NH_4).HPO_4$, Na_3PO_4, Na_2SiO_3, and acetic, oxalic, succinic, tartaric, and citric acids. By working in a room at about 3° C., the temperature variations of which did not exceed 0.5° C., the experimental error previously estimated at 0.001° C. has been reduced one-half. Among the important relations brought to light by a consideration of the results may be mentioned the following: The molecular depression of the freezing-point of all chlorides reaches a minimum value which is especially pronounced in the case of the chlorides of the alkali earths. Stannic chloride exhibits an abnormally large molecular lowering, 12.61 for $m = 0.01$, which is probably to be explained by its being highly hydrolyzed in dilute solution. A study of the phosphates indicates that salts of the type KH_2PO_4 are dissociated into two ions, K and H_2PO_4; salts of the type K_2HPO_4 into three ions, K, K, and HPO_4; while the neutral phosphate K_3PO_4 is dissociated into four ions. Phosphoric acid itself is, as has been long known, but little dissociated, only one hydrogen ion being probably split off from the molecule. Sodium silicate also gave abnormal lowerings, the higher values observed being undoubtedly due to an hydrolysis of the salt. Acetic, tartaric and succinnic acids, and also the chlorides of lithium and calcium gave results in complete agreement with those of electrical conductivity measurements. Nitric acid, and potassium and sodium hydroxide, on the other hand, gave results for the dissociation deviating as much as 8 to 11 per cent. from conductivity values. The reason for this discrepancy is not known. It seems to the reviewer that much weight should be given to the results of this investigator, in view of the clearness with which he has discussed the precision side of this problem and his thorough appreciation of the nature and magnitude of the errors affecting his measurements.

On the Formation of Lead Sulphate in Alternating Current Electrolysis with Lead Electrodes. BY SAMUEL SHELDON AND MARCUS B. WATERMAN. *Phys. Rev.*, 4, 324–327.—The formation of lead sulphate by the passage of an alternating current through a sulphuric acid solution between lead electrodes was found to diminish with rise of temperature, to increase very rapidly with the number of alternations up to twenty per second, after which it decreases, and to increase rapidly to a constant value with increasing current density.

Polarization and Internal Resistance of a Galvanic Cell. BY B. E. MOORE AND H. V. CARPENTER. *Phys. Rev.*, 4, 329–336. —The authors have studied the polarization at each electrode of a Leclanche cell, by combining each successively with a third non-polarized carbon electrode kept on open circuit. Both electrodes were found to be polarized, the larger part of the total polarization of the cell being at the carbon electrode however. That zinc in ammonium chloride would by the passage of any considerable current become polarized might have been predicted from Nernst's theory of the cell, since it is a non-reversible electrode with respect to the kation. The rapid recovery of the electromotive force of the cell on open circuit was found to be largely due to recovery from polarization at the zinc electrode, the recovery at the carbon electrode being much slower.

ANALYTICAL CHEMISTRY.

ULTIMATE ANALYSIS.

H. P. TALBOT, REVIEWER.

Table of Factors. BY EDMUND H. MILLER AND J. A. MATHEWS. *J. Am. Chem. Soc.*, 18, 903–904.—The table presents about fifty factors, commonly required for analytical work. They are calculated from the atomic weights published in Clarke's table (*J. Am. Chem. Soc.*, 18, 213). The use of seven-place logorithms, and six decimal places in the values of the factors is somewhat misleading and involves unnecessary labor. Five-place logorithms suffice for the highest accuracy in chemical analysis, and even four-place logarithms and four places of decimals in the factors are sufficiently accurate, except in a few extreme cases.

Some Analytical Methods Involving the Use of Hydrogen Dioxide. BY B. B. ROSS. *J. Am. Chem. Soc.*, 18, 918–923.—The author proposed to determine iron by a procedure in which an excess of potassium bichromate is added, which is allowed to react with hydrogen peroxide, and, from the volume of oxygen liberated, the excess of bichromate is estimated. A similar procedure is proposed for the determination of sugar, wherein cuprous oxide is to be oxidized by potassium bichromate, and the excess of the latter estimated from the oxygen evolved on contact with hydrogen peroxide. The article leaves the reader in doubt whether or not the processes proposed have any real value.

The Separation of Thorium from the Other Rare Earths by Means of Potassium Trinitride. BY L. M. DENNIS. *J. Am. Chem. Soc.*, 18, 947–952.—The author shows that thorium is quantitatively precipitated as hydroxide by potassium trinitride, and that its separation from cerium, lanthanum, and didymium may be promptly and completely effected by means of this reagent.

Notes on Reinsch's Test for Arsenic and Antimony. BY JAS. LEWIS HOWE AND PAUL S. MERTINS.—*J. Am. Chem. Soc.*, 18, 953–955.—The authors find that a confusion of antimony with arsenic in this test is not likely to occur, since on heating the copper upon which the deposition has taken place, the arsenic forms well defined octrahedral crystals of the oxide, while the antimonious oxide shows no trace of crystallization. The deposition in the case of the arseniates is slow, and it fails altogether in the presence of nitric acid or chlorates. Organic matter does not interfere with the test. The antimony deposits more slowly than arsenic on the copper and shows a violet tint.

Notes on the Determination of Phosphorus in Steel and Cast Iron. BY GEORGE AUCHY. *J. Am. Chem. Soc.*, **18**, 955–970.—From the experiments cited, the author concludes that in order to insure a complete reduction of the molybdic acid to Mo_2O_3 dilution must be absolutely avoided after the solution has passed the reductor; that it is not necessary to wash out the reductor with acid, except after long standing; that when the zinc for reduction is placed in the liquid and the excess removed by filtration, the molybdic acid is reduced only to $Mo_{12}O_{19}$; that dilute solutions of this oxide are less stable than concentrated solutions; that a boiling temperature must be avoided during reduction and solution of the zinc, and that air must be excluded while cooling the solution before filtration; that cotton wool is preferable to paper as a filtering medium; that a considerable excess of sulphuric acid increases the stability of the reduced solution; and that the reduction by means of zinc within the solution, the excess of which is removed by filtration through cotton, is the most desirable method for phosphorus determinations. He also finds that sugar may be used to reduce and dissolve the manganese dioxide from the permanganate added to oxidize the phosphorus.

Metal Separations by Means of Hydrochloric Acid Gas. BY J. BIRD MOYER. *J. Am. Chem. Soc.*, **18**, 1029–1044.—The author's results may be briefly summarized as follows: Antimony trioxide was completely volatilized when treated in an atmosphere of dry hydrochloric acid; lead oxide changed to chloride, volatile at 225° C.; bismuth oxide completely volatilized; copper oxide changed to chloride, if first moistened with hydrochloric acid and dried. By means of these reactions the separation of lead from antimony, lead from bismuth, antimony from copper, and bismuth from copper may be effected. The arsenic may be volatilized from the arseniates of sodium, copper, silver, cadmium, cobalt, and nickel. The separation of the arsenic from iron and zinc is difficult. The arsenic and nickel in niccolite were separated after solution in nitric acid and evaporation to dryness.

The Separation of Vanadium from Arsenic. BY CHARLES FIELD, 3RD, AND EDGAR F. SMITH. *J. Am. Chem. Soc.*, **18**, 1051–1052.—Arsenic sulphide is completely volatilized from its mixture with vanadium sulphide without change of the latter, if treated in an atmosphere of dry hydrochloric acid, below 250° C. The separation may be utilized for quantitative analysis.

The Separation of Manganese from Tungstic Acid. BY WALTER T. TAGGART AND EDGAR F. SMITH. *J. Am. Chem. Soc.*, **18**, 1053–1054.—The authors' results are entirely negative, simply showing that neither yellow ammonium sulphide nor potassium carbonate are suitable reagents to effect the separation of the elements named. They make the independent statement that molybdic sulphide may be easily converted to oxide by ignition with anhydrous oxalic acid, after drying.

The Separation of Bismuth from Lead. By Arthur L. Benkert and Edgar F. Smith. *J. Am. Chem. Soc.*, **18**, 1055-1056.—The authors find that a quantitative separation can be effected by double precipitation of the bismuth as a basic formate, from a formic acid solution.

The Determination of Sulphur in Cast Iron. By Francis C. Phillips. *J. Am. Chem. Soc.*, **18**, 1079-1086.—The author finds that white iron may be completely oxidized, with the conversion of the sulphur to sulphates, by fusion of the finely divided iron with sodium peroxide or a mixture of sodium carbonate and sodium nitrate. Ferromanganese may be successfully oxidized by sodium carbonate and sodium nitrate. The percentages of sulphur determined by this method are apparently higher than by oxidation with nitric acid.

Carbon Determinations in Pig Iron. By Bertrand S. Summers. *J. Am. Chem. Soc.*, **18**, 1087-1091.—The paper describes several devices to expedite the burning of large residues, for use in connection with the combustion apparatus, by means of which the most refractory residues may be burned in an hour and a half. The author finds the chromic acid method unreliable.

Notes on the Solubility of Bismuth Sulphide in Alkaline Sulphides. By George C. Stone. *J. Am. Chem. Soc.*, **18**, 109.—The author finds that bismuth sulphide, which has been precipitated from acid solution, is not soluble in potassium or ammonium sulphide. Compare *J. Am. Chem. Soc.*, **18**, 683.

The Analysis of Coke. By George C. Davis. *Am. Manufacturer*, **59**, 804.—The author claims that the foundryman does not need to know the percentage of phosphorus in the coke used, but should know the percentage of ash and of sulphur. The usual proximate analysis of coke, and the Eschka method for sulphur determinations are imperfectly described, but the paper presents no new facts.

On the Chemistry of the Cyanide Copper Assay. By J. J. Beringer and H. W. Hutchin. *Eng. Min. J.*, **62**, 390-391.—The authors show that if potassium cyanide is addded to a solution of copper sulphate, until the precipitate which first forms is just redissolved, and ammonia is then added, a blue solution slowly forms. The color is intensified by the addition of ammonium nitrate. Increased quantities of ammonia, or ammonium salts do not necessarily intensify the reaction. A similar result was obtained if cupric cyanide is shaken with ammonia or ammonium nitrate. This may be decolorized by the addition of cyanide, but ammonia again restores the blue. The maximum quantity of cyanide was used in one case when only ammonia was present, in another where three-eighths of the ammonia was neutralized by hydrochloric acid. The reaction between the cupric cyanide and ammonia the authors express by the equation: $2Cu(CN)_2 + 6NH_3 + 2H_2O = 4NH_3.Cu(OH)_2 + (NH_4)_2Cu(CN)_4$, and they believe that their experiments and the general experience with the cyanide process suggest a "reversible reaction with a slowly attained state of equilibrium."

On the Application of Certain Organic Acids to the Estimation of Vanadium. BY PHILIP E. BROWNING AND RICHARD J. GOODMAN. *Am. J. Sci.*, 152, 355–360.—The possibility of the estimation of vanadic acid by means of a standard iodine solution, (reduction having been effected by boiling with tartaric acid), is confirmed, and it is further shown that neither tungstic nor molybdic acids are reduced by tartaric acid in cold solution, and that tungstic acid is unaffected by either oxalic, tartaric, or citric acids in boiling solution, while citric acid reduces vanadium under these conditions. The general procedure is as follows: To a solution of vanadium, which may contain also a molybdate, or tungstate, add approximately one gram of acid (either tartaric, oxalate, or citric), for each one-tenth gram of substance. Heat the solution to boiling, unless tartaric acid is used in the presence of molybdates; in this case digest in the cold from fifteen to twenty hours. Add to the cold liquid five grams of potassium bicarbonate for each gram of acid used, add iodine solution and set aside until no further bleaching action is evident. Titrate for the excess of iodine with arsenious acid solution.

The Determination of Oxygen in Air and in Aqueous Solution. BY D. ALBERT KREIDER. *Am. J. Sci.*, 152, 361–367. —The author adapts for these determinations a procedure already described by him (*Am. J. Sci.*, 150, 287), wherein oxygen is allowed to act upon a concentrated solution of hydriodic acid, in the presence of nitric oxide. The excess of the acid is neutralized by potassium bicarbonate and the liberated iodine titrated with arsenious oxide. For these determinations the author uses special forms of apparatus, which are described in detail in the original article, together with all necessary precautions.

[CONTRIBUTION FROM THE MASSACHUSETTS INSTITUTE OF TECHNOLOGY.]

REVIEW OF AMERICAN CHEMICAL RESEARCH.

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ARTHUR A. NOYES, Editor; HENRY P. TALBOT, Associate Editor.

REVIEWERS: Analytical Chemistry, H. P. Talbot; Biological Chemistry, W. R. Whitney; Carbohydrates, G. W. Rolfe; General Chemistry, A. A. Noyes; Geological and Mineralogical Chemistry, W. O. Crosby; Inorganic Chemistry, Henry Fay; Metallurgical Chemistry and Assaying, H. O. Hofman; Organic Chemistry, J. F. Norris; Physical Chemistry, H. M. Goodwin; Sanitary Chemistry, E. H. Richards; Technical Chemistry, A. H. Gill and F. H. Thorp.

ANALYTICAL CHEMISTRY.

W. H. WALKER, REVIEWER.

The Separation and Determination of Potassium and Sodium. BY D. ALBERT KREIDER AND J. E. BRECKENRIDGE. *Am. J. Sci.*, 152, 263–268.—The paper presents a qualitative method for the separation and detection of potassium and sodium based on the relative solubilities of the perchlorates. It has been shown that, while sodium perchlorate is readily soluble in 97 per cent. alcohol, the potassium salt is, on the contrary, insoluble in that menstruum. This paper provides a method by which sodium may be detected after it has been separated from the potassium, which is essentially as follows: To the filtrate from which all the bases, including ammonia, have been removed, 0.5 cc. of pure perchloric acid (sp. gr. 1.70) is added, and the solution is evaporated on the steam-bath until white fumes of perchloric acid appear. When the quantity of sodium is large it is safer to evaporate several times to secure complete conversion to the perchlorate. Upon treating with 97 per cent. alcohol, the presence of potassium is revealed by the existence of an insoluble residue, which is collected on a dry filter. When the filtrate is saturated with gaseous hydrochloric acid, sodium, if present in amounts greater than 0.0005 gram, will appear as a granular precipitate. The authors think the method is all that can be desired for qualitative determinations. Perchloric acid free from sodium was made by distilling (under a pressure of from 3 to 5 mm. of mercury) acid prepared according to the procedure described by Kreider, *Am. J. Sci.*, 149, 443). This must be done very slowly and in a specially prepared apparatus.

Estimation of Cadmium as the Oxide. BY P. E. BROWNING AND L. C. JONES. *Am. J. Sci.*, 152, 269–270.—The authors demonstrate the ease and accuracy with which cadmium carbonate may be ignited in a Gooch crucible and weighed as oxide, eliminating all danger of the reduction and subsequent volatilization of the cadmium. The precipitation is made in a hot aqueous solution by means of a ten per cent. potassium carbonate solution, and the liquid is boiled for ten or fifteen minutes until the precipitate becomes granular. It is then filtered upon asbestos, washed thoroughly, and ignited at a red heat to a constant weight. The results show a very small plus error, which the authors prove to be due to slight inclusions of the alkaline carbonate.

The Determination of Tellurium by Precipitation as the Iodide. BY F. A. GOOCH AND W. C. MORGAN. *Am. J. Sci.*, 152, 271–272.—It has been already shown that when hydriodic acid and tellurious acid interact there is formed a tellurium tetraiodide which is converted by water into an oxyiodide, and by excess of an alkaline iodide into a soluble double salt. The authors show that this reaction takes place according to the equation:

$$H_2TeO_3 + 4H_2SO_4 + 4KI = TeI_4 + 4KHSO_4 + 3H_2O,$$

and this is made the basis of a volumetric method for the direct determination of small amounts of tellurium. By shaking the flask the precipitate of tellurium tetraiodide, which at first separates in a finely divided condition, is made to gather into a curdy mass and so leave a clear supernatant liquid. Advantage is taken of this behavior, and the point at which the precipitation of all the tellurium is complete is not difficult to determine. In the test experiments, the tellurium dioxide was dissolved in potassium hydrate, and sulphuric acid of half strength was added in such an amount that at the end of the titration the solution should contain one-fourth its volume of strong sulphuric acid. This solution is then titrated with a decinormal potassium iodide solution, until a further addition gives no precipitate. Using 127 as the atomic weight of tellurium, the authors find this method satisfactory.

Method for the Separation of Aluminum from Iron. BY F. A. GOOCH AND F. S. HAVENS. *Am. J. Sci.*, 152, 416–420.—When a cooled concentrated acid solution of aluminum and iron chlorides is saturated with gaseous hydrochloric acid, almost all the aluminum separates in fine white crystals of hydrated aluminum chloride, $AlCl_3.6H_2O$, while all the iron remains in solution. On this difference in solubility is based a method of separation. The solubility of aluminum chloride in concentrated aqueous hydrochloric acid is very small, and is, moreover, greatly reduced by the addition of an equal volume of anhydrous ether. A complete separation seems to be most easily secured by mixing the concentrated aqueous solution of the chlorides with enough concentrated hydrochloric acid to make the entire volume 15–25 cc., cooling to about 15° C. and passing into the solution gaseous hydrochloric acid. When completely saturated, the solution is mixed with an equal volume of anhydrous ether; and this mixture again saturated with gaseous hydrochloric acid. The crystalline precipitate of hydrous aluminum chloride is collected on asbestos in a perforated crucible and washed with a mixture of equal parts of aqueous hydrochloric acid and anhydrous ether saturated with the gas. When the precipitate is ignited directly, the mechanical loss occasioned by the rapid volatilization of the acid and water of crystallization is so great that it was found expedient either to dissolve in water and reprecipitate as hydroxide, or to cover the chloride with some volatile oxidizing agent before ignition. Mercuric oxide was found to serve the purpose well. The precipitate is dried for one-half hour at 150° C., covered with about one gram of mercuric oxide, first gently heated under a ventilating flue, and then freely over the blast lamp. The results seem to be satisfactory.

PROXIMATE ANALYSIS.

A. H. GILL, REVIEWER.

On the Determination of Stearic Acid in Fat. BY O. HEHNER AND C. A. MITCHELL. *J. Am. Chem. Soc.*, 19, 32-51.—The method prepared by the authors is a quantitative one, unlike the classical method of Heintz; it consists in dissolving out at 0° the other fatty acids by alcohol saturated with stearic acid, and in weighing the residue consisting of stearic acid.

The Determination of Solid Fats in Compound Lards. BY G. F. TENNILLE. *J. Am. Chem. Soc.*, 19, 51-54.—The author shows that Wainwright's method at best cannot be depended upon for results closer than 1.5 per cent., and that, if the conditions are at all varied, the results may be 7 or 8 per cent. too high or too low.

F. H. THORP, REVIEWER.

Volumetric Determination of Acetone. BY EDWARD R. SQUIBB. *J. Am. Chem. Soc.*, 18, 1068–1079; *Squibb's Ephemeris*, 4, 1759–1770.—This is a description of certain improvements in the process of J. Robineau and G. Rollin (*Moniteur Scientifique*, 41, 272–274), whereby greater simplicity, rapidity and ease of manipulation are secured, with sufficient accuracy for most purposes. The method is applicable to the determination of acetone in the presence of ethyl alcohol, and is especially recommended for use in testing the dilute solutions of acetone which are recovered by distillation in manufacturing operations, or in the making of acetone itself. For the details of the process reference must be made to the original article.

G. W. ROLFE, REVIEWER.

On the Conditions Affecting the Volumetric Determination of Starch by Means of a Solution of Iodine. BY F. T. LITTLETON. *Am. Chem. J.*, 19, 44–49.—The author has made an investigation of the colorimetric method proposed by Dermstedt and Voigtländer (abstracted in *The Analyst*, 20, p. 210), and finds that the process has very little analytical value, owing to the varying composition of the iodide of starch, possibly due to dissociation, under different conditions of temperature, solvents, etc.

W. R. WHITNEY, REVIEWER.

A Modification of the Gunning Method for Nitrates. BY JOHN FIELDS. *J. Am. Chem. Soc.*, 18, 1102–1104.—The author claims to avoid the trouble caused by frothing in the Gunning method by gently heating the mixture of the sample with the sulphuric and salicylic acids, and then gradually adding 6–7 grams of potassium sulphide with shaking. The whole is boiled; and the digestion is usually complete in an hour. Distillation is then proceeded with as usual. Results have shown the modification to be as accurate as the Gunning method itself.

Notes on the Estimation of Caffein. BY W. A. PUCKNER. *J. Am. Chem. Soc.*, 18, 978–981.—This is an experimental study of the extraction of caffein from dilute acid solutions by means of chloroform.

E. H. RICHARDS, REVIEWER.

Methods for the Determination of Organic Matter in Air. BY DAVID HENDRICKS BERGEY. *Smithsonian Miscellaneous Collection*, 1037, 1–28. This publication is a critical compendium of the various methods proposed for the estimation of the organic impurities in air. The results lead to the conclusion that the dust in the air is the chief source of organic matter. The use of pumice has found greater favor with the author than the experience of the reviewer would warrant. Moreover, no notice is taken of the effect of the presence of nitrites in using permanganate.

A Modification of the Babcock Method, and Apparatus for Testing Milk and Cream. BY J. M. BARTLETT. *Me. State College Agr. Expt. Sta., Bull.* 31, 1–8.—The author recommends adding hot water five minutes after mixing the sulphuric acid and milk or cream together, and claims that once whirling is then sufficient to cause the separation of the fat. The acid used (20 cc.) should have at 60° F. a specific gravity of 1.820–1.825, and the milk or cream (18 cc.) should be at a temperature of 70°-80° F., when it is mixed with the acid. A modified form of the graduated milk and cream bottles is also described.

TECHNICAL CHEMISTRY.

F. H. THORP, REVIEWER.

The Manufacture and Use of Thomas Slag. BY F. E. THOMPSON. *Iron Age*, 59, 9.—The author first describes the treatment of the slag as made in the basic Bessemer process. Its value as a fertilizer is increased, if it is exposed to the weather several years before grinding; but it may be ground as soon as cold. It is prepared by grinding in a "ball-mill" until 90 per cent of it will pass a 100-mesh sieve. A series of sieving tests is given. The fertilizer value depends on the quantity of phosphoric acid present, and on its condition. In Thomas slag the phosphoric acid is present as tetracalcic phosphate, which is not so soluble in neutral ammonium citrate, as is "reverted" phosphate or dicalcic phosphate; but it is much less stable than tricalcic phosphate. The author then considers the causes of irregularities in the composition of the slag, which he charges to the method of running the converter. The methods of analysis of this slag are then discussed. From his investigations he concludes that neutral ammonium citrate does not give a correct estimate of the fertilizer value of the phosphoric acid; for it appears to dissolve the slag as a whole, and the per cent. of phosphoric acid dissolved bears a direct ratio to the total quantity of slag dissolved. Moreover, there is no evidence to show any difference between the phosphoric acid which it leaves in the slag and that which it dissolves out. Weathering appears to increase the solubility of the phosphoric acid in neutral ammonium citrate. The author considers Thomas slag to be a mixture of chemical compounds; for, if cooled slowly, several bodies separate as distinct crystals. According to recent reports, the slag is but slightly inferior as a fertilizer to dissolved bone or phosphate rock, and is superior to all insoluble phosphates.

American Utilization Processes of Garbage Disposal. BY W. E. GARRIGUES. *Trans. Eng. Soc. Western Pa.*, 12, 266-276.—This is a condensed review of the system of garbage disposal in several large cities. The destructive processes are not discussed. The useful products obtained from garbage are grease and tankage. Grease is chiefly used for glycerine and candle stock. It will make only a very poor soap. Three systems of grease extraction are considered: with steam; by means of sulphuric acid; and by the use of naphtha. Tankage is used by the fertilizer manufacturers.

Composition of American Kaolins. By Charles F. Mabery and Otis T. Klooz. *J. Am. Chem. Soc.*, **18**, 909–915.—This article consists chiefly of analyses of clays from various places in the United States. Two analyses of the kaolin used at the Royal Berlin porcelain works at Charlottenburg are included for comparison. Several of the American clays approach very nearly the composition of the German article.

Chrome Tannage Patent. By Geo. W. Alder. *U. S. Pat. No. 573631.* (Abstract, *Leather Manufacturer*, 7, 19).—The chrome solution is prepared by dissolving potassium or sodium bichromate in an excess of sulphuric acid diluted with two volumes of water, reducing the chromium salt by the addition of sugar or alcohol, then neutralizing and precipitating chromium hydrate and "chromium oxycarbonate" by the addition of sodium carbonate, and finally dissolving the precipitate, without filtering, by the addition of hydrochloric acid to the mixture. The resulting liquor is supposed to contain chromium chloride, chromium sulphate, sodium and potassium sulphates, sodium chloride, and either formates or acetates of these metals.

Chrome Tannage Patent. By Hugo Schweitzer. (Abstract *Leather Manufacturer*, 7, 20.)—The process consists in the "reduction on the animal fiber of bichromate of potash by means of hydroxylamine compounds, such as hydroxylamine, its sulpho acids and salts, in the presence or absence of any of the nitrogen-sulphone acids, which are formed to some extent in the reaction, which produces sulpho acids of hydroxylamine, thereby permitting the use of neutral, weakly acid or weakly alkaline solutions for the second bath."

Chrome Tannage Patent. By Robert Wagner and J. J. Maier. *U. S. Pat. No. 574014.* (Abstract *Leather Manufacturer*, 7, 19.)—This is a one-bath chrome tannage process. It is proposed to take ten pounds of chrome alum, three pounds of saltpeter, six pounds of muriatic acid, fifteen pounds of salt, and ten pounds of whiting, and mix them with fifteen gallons of water. The whiting and salt are first mixed together (dry?) at a temperature of 70° (F?), and then the other ingredients are added and the whole stirred into the water.

Manufacture and Development of Carborundum at Niagara Falls. By Francis A. Fitzgerald. *J. Franklin Inst.*, 143, 81–96.—After a discussion of the early forms of furnace, the author takes up the subject of the manufacture at Niagara. The materials used are sand, coke, sawdust, and salt. These are properly mixed and filled into an oblong brick furnace 16x5x15 feet, in the ends of which are the terminals consisting of 60 carbon rods 30 inches long and 3 inches in diameter. Connection between each carbon and the end plate is made with $\frac{3}{8}$ inch copper rod. The side walls of the furnace are built up each time a charge is introduced. The current used in the furnace at first is about 1200 amperes; but after the charge becomes hot the resistance decreases, and at the end of an hour the current is such that 746 kilowatts (or 1000 horse-power) are being used in heating the furnace. As the current increases, the electromotive force is reduced, until finally the resistance becomes constant. No apparent change is observed for half an hour; but then inflammable gases begin to escape from the furnace. After three or four hours the top of the furnace is covered by blue flames of carbon monoxide, which escapes in great quantities. After twenty-four hours the current is cut off, and the furnace cools. The side walls are removed; and the unchanged, loose mixture is raked off. The core is crystalline at the center; and about 4000 pounds of crystalline carborundum are obtained from one furnace. The carborundum is crushed, treated with dilute sulphuric acid, washed, and dried. After sifting it is ready for use. Carborundum is infusible, decomposing without melting; it is insoluble in water and acids; it has a hardness near 10; and its specific gravity is 3.23. It is replacing emery for many purposes.

Manufacture of Oxygen. BY MR. LINTON. *Proc. Eng. Soc. Western Pa.*, **12**, 222–231.—This is a review of the commercial methods of making oxygen, with special reference to the process of E. B. Stuart, of Chicago. It is similar to the Tessie du Motay process; but it is claimed that it avoids some of the difficulties of that method. A mixture of caustic soda and black oxide of manganese is heated to 500°–600° F., and the air is blown through it, by which process sodium manganate is formed. Steam is then blown through the mass, which dissociates the manganate, forming caustic soda, manganese binoxide and oxygen. The air is blown in for ten minutes and the steam for five minutes. The manganate mass obtained consists of one part manganate to two of caustic soda. It fuses to a liquid at the temperature of the reaction, which is carried on in cast iron retorts, set vertically. Each retort is charged with 1500 pounds of the mixture, and the two retorts yield 76,000 cubic feet of gas in twenty-four hours, at a cost of 7 cents per 1000 cubic feet.

Second International Congress of Applied Chemistry. BY H. W. WILEY. *J. Am. Chem. Soc.*, **18**, 923.—This is a review of the proceedings of the meeting held at Paris, in July and August, 1896.

A. H. GILL, REVIEWER.

Some Facts about Acetylene Gas. BY J. C. M'MYNN.

Electr. Eng., **21**, 197–198.—This is a concise statement of the present knowledge of the subject.

Fuels. BY A. V. ABBOTT AND F. J. DOMMERQUE. *Electr. Eng.*, **9**, 1–186.—This article deals succinctly with the origin, distribution, production and composition of the various fuels—wood, peat, coal, petroleum and gas, and discusses the advantages of each. A special and valuable feature of the treatise is the numerous tables and plots which it contains. The methods of proximate fuel analysis and of manipulating the Carpenter calorimeter, the Mahler bomb, and the Elliott gas apparatus are also given—in some cases, however, with insufficient detail as to their execution. As the article does not present original material, this reference to it will suffice.

The Testing of Coals. BY ARTHUR WINSLOW. *J. Assoc. Eng. Soc.*, **17**, 84.—The paper is the outline of a plan of the author to study the North American coals, considering their adaptability for: (1) Steaming; (2) Coke making; (3) Domestic use; (4) Gas making; and (5) Blacksmithing. This article gives the properties of coals adapted to each of these uses. The investigation will be an interesting and exceedingly important one—one almost beyond the power of any one man to execute. A comparison of the calorific power as obtained by the calorimeter and by the Dulong formula would be very instructive. It is to be regretted that the Barrus calorimeter is to be used for the determination of the calorific power, as its results may vary as much as three per cent. from those obtained by the Mahler apparatus.

G. W. ROLFE, REVIEWER.

A Study of the Clarification of Sugar Cane Juices. BY J. L. BEESON. *J. Am. Chem. Soc.*, **19**, 56–61.—This paper is related to those previously published (*La. Sta.*, *Bull.* 38; *this Rev.*, 2, 110.). In an investigation of the commercial process of clarification ("defecation,") as applied to cane juices, the author finds that the gums and albuminoids of the juice fall into three classes: (*a*) those which form insoluble compounds with lime; (*b*) those which are precipitated by heat; and (*c*) those which are not rendered insoluble by either lime or heat. The latter class, however, can be precipitated by suitable reagents, and are found to comprise nearly one-half of the total amount of gums and albuminoids.

BIOLOGICAL CHEMISTRY.

W. R. WHITNEY, REVIEWER.

The Tannin of Some Acorns. BY HENRY TRIMBLE. *Am.*

J. Pharm., **68**, 601–604.—The author has determined the tannin, moisture, and ash in different parts of the chestnut-oak acorn (*Quercus Prinus*) during the month of September when ripening occurs. As few comparative results are given, no important conclusions can be drawn as to the change in the quantity of tannin in different parts of the fruit during growth. The greatest amount of tannin comes from the testa, where over 48 per cent. was found. A comparison of the tannin of the cupule with that from many samples of oak bark was made, and analyses of both were carried out. The two are evidently identical. The article concludes with the results of the analyses of six different samples of acorn cupules.

Alfalfa. By William P. Headden. *Col. Agr. Expt. Sta.*; *Bull.* 35, 1–92.—The author gives the results of his study of the plant, embracing analyses of each of the three cuttings of a season, and showing the amount and composition of the ash of the whole plant above ground at different degrees of maturity. Analyses were also made of the separate parts of the plant, the soil, etc. The analyses included determinations of moisture, ash, ether extract, crude protein, crude fiber, nitrogen-free extract, and amide nitrogen. Complete analyses of the ash are also given. In an appendix the methods of analysis and of the preparation of the samples are described, and a compilation of fodder analyses is given.

Rectification of Turpentine Oil. By Edward Kremers. *Pharm. Rev.*, **15**, 7.—The author has carefully fractionated the commercial product after treating it with milk of lime. Tables giving the specific gravity and rotatory power of the fractions are given. He notes also that the rectified product undergoes the so-called resinification on standing.

The Caffein Compounds of Kola. By James W. T. Knox and Albert B. Prescott. *J. Am. Chem. Soc.*, **19**, 63–90; *Am. Pharm. Assoc. Proc.*, 1896.—This article gives an abstract of the existing chemical literature on kola, describes in detail methods for the determination of its free and combined alkaloids (chiefly caffein), presents analytical results obtained with different samples, and describes the separation, properties, composition, and artificial preparation of the glucoside present in kola.

The Chemistry of the Cotton Plant. By J. B. McBride and W. H. Beal. *U. S. Dept. Agr.*, *Bull.* 33, 81–142.—This article shows the fertilizing and proximate constituents of all parts of the cotton plant—the roots, stems, leaves, bolls, lint, seeds, etc. Tables containing the results of hundreds of analyses are given, the entire subject having been very thoroughly treated.

Purification of Natural Cumarin. BY EDO CLAASSEN. *Pharm. Rev.*, 15, 28.—The crude cumarin is treated with hot benzine (sp. gr. 0.71), from which it crystallizes on cooling. The final portion of cumarin is separated from the benzine solution by shaking this with a five per cent. sodium hydrate solution.

On the Occurrence of Sulphur Derivatives in American Peppermint Oil. BY CLEMENS KLEBER. *Pharm. Rev.*, 14, 269.—The author shows the presence of dimethyl sulphide in American peppermint oil.

Terpin Hydrate. BY EDWARD T. HAHN. *Am. J. Pharm.*, 69, 73–75.—This short article contains a resumé of the methods for the production of terpin hydrate from turpentine. The author finds that by using oil of turpentine, methyl alcohol (sp. gr. 0.801) and nitric acid (sp. gr. 1.35) in the volume proportions 4 : 1 : 1, a satisfactory yield of the crystalline product is most quickly obtained. The crystallization is hastened by the addition of one volume of water after the reaction is complete.

A Contribution to the Knowledge of Some North American Coniferae. BY EDGAR S. BASTIN AND HENRY TRIMBLE. *Am. J. Pharm.*, 69, 90.—This portion of the work treats of the hemlock (*Tsuga Canadensis*). Samples of the bark were analyzed by fractional extraction, and the tannin also determined. Pure hemlock tannin was isolated and analyzed; the results show it to be unexpectedly high in carbon and hydrogen and are not in agreement with the formula proposed by Boettinger, $C_{20}H_{18}O_{10}$. The authors found nearly half a per cent. more carbon in the hemlock tannin than in any one of ten oak tannins examined.

Chemical Analysis of the Bark of Honey Locust (Gleditschia Triacanthos). BY LOUIS P. CARSTENS. *Am. J. Pharm.*, 69, 40–41.—This article contains the results of the analysis by the usual extraction methods of a sample of the bark mentioned in the title. The alkaloid extracted with 95 per cent. alcohol was removed from the solution by chloroform, and crystallized from absolute alcohol.

Assay of Johore Gambier. BY W. O. RICHTMANN. *Pharm. Rev.*, 15, 27–28.—Results of analyses of six different samples are given, showing the amounts of moisture, ash, tannin, and catechin present. The author suggests that possibly a definite relation exists between the amounts of catechin and tannin in different gambiers; for a low quantity of the one seems to occur where there is a relatively large quantity of the other. The conversion of one into the other may be brought about, he believes, by some vegetable organism.

Concerning Preperties Belonging to the Alcohol Soluble Proteid of Wheat and of Certain Other Cereal Grains. By G. L. Teller. *Am. Chem. J.*, 19, 59–61; *Ark. Agr. Expt. Sta.*, *Bull.* 42, 75–104.—In working with the proteids in wheat, the author. observed that some nitrogen-containing substance was soluble both in dilute salt solution and in the 75 per cent. alcohol usually employed. This substance was shown to be a proteid by the usual reactions. Analyses of twenty different samples of wheat and other mill products showed that the nitrogen-content of this soluble proteid was practically the same in each case, while the other nitrogenous constituents varied considerably. The author believes the proteid to be gliadin. It has many of the properties of proteoses; but it is readily soluble in 75 per cent. alcohol, and from this solution it is not precipitated by common salt. The same or a similar body was found in the alcohol extracts of oats, rye, and barley. The experiments are more fully described, and detailed methods for the quantitative separation of the proteid are given in the *Bulletin*.

The Action of Enzymic Ferments upon Starches of Different Origins. By Winthrop E. Stone. *U. S. Dept. Agr.*, *Bull.* 34, 29–44.—The author's belief that starches from different sources are not identical, but that there are isomeric starches as there are isomeric sugars, is supported by experiments on the relative rates of decomposition of maize, wheat, rice, potato, and sweet potato starches, usually in the gelatinized state, by the enzymic ferments—malt diastase, ptyalin from human saliva, and pancreatin from beeves and swine. It was found that the time required for the complete decomposition of the different starches as determined by the failure of the iodine. test, varied greatly with the source of the starch in the case of each of the ferments, and that the orders of susceptibility of the different starches to the various enzymes were also widely different.

G. W. Rolfe, Reviewer.

The Carbohydrates of Wheat, Maize, Flour and Bread. By W. E. Stone. *U. S. Dept. Agr.*, *Office of Exp. Sta.*, *Bull.* 34, 7–28.—A large amount of analytical data is given comprising estimations not only of the carbohydrates—the more common polysaccharides, hexoses and pentose derivatives—but also of ash, fat, fiber, and proteids. The change of composition, due to milling and baking, are discussed in considerable detail, the views in general conforming to the opinions usually accepted. The most extraordinary feature of the paper is the remarkable starch showing. The author finds by his analyses that the starch-content of the cereals are from 20–30 per cent. lower than the figures generally given. What is yet more strange is that the figures of the other components show a practical agreement with the results of other investigators, so that a deficit of over 20 per cent. is left to be accounted for. This fact the author does not explain, but leaves us to infer that this large fraction of the grain is in reality totally overlooked in our usual methods of investigation, the discrepancy presumably being marked by the too high results of faulty starch determinations. Aside from an opinion that this missing material is not carbohydrate nor indeed food, the author gives no hint as to its nature, not even attempting a separation by solvents or other rough method of classification to throw light upon the mystery. It is certainly most remarkable if we are to believe that in the present state of the science practically a quarter of our common cereals consists of material in regard to whose nature we have not the most primitive ideas! In consideration of the importance of the matter and of the disagreement of the results with those of previous investigators, the reviewer suggests that a more complete and detailed explanation of the author's method of starch determination would have been most acceptable to his readers. Confidence in the results would have been greatly increased by statements in regard to the amount of reducible carbohydrates produced by the presence of the malt infusion, apparently no inconsiderable fraction of the whole; in regard to the methods of correction, the details of the Fehling test, the precautions taken by the author to satisfy himself that the final acid hydrolysis actually converted the carbohydrate to dextrose; and in regard to other minor points.

F. H. THORP, REVIEWER.

Mineral Constituents of the Watermelon. BY G. F. PAYNE. *J. Am. Chem. Soc.*, 18, 1061-1063.—**The Ash Analysis of the Watermelon, giving the Mineral Substances It Takes from the Soil.** BY G. F. PAYNE. *Ga. Dept. Agr. Bull. No.* 32, 29–31. Two melons gave, on analysis, 0.33 per cent. of ash, which was itself analyzed. The author concludes that a crop of 39,766 pounds per acre (which is three times the average yield per acre) takes from the soil 81.09 pounds of potash and 13.59 pounds of phosphoric acid.

The Use of Arsenites on Tobacco. BY H. GARMAN. *Ky. Sta Bull.* 63, 68–80.—This investigation is a study of the effect of spraying tobacco with Paris green. Samples of the dry tobacco were analyzed; and arsenic was found in all of them in amounts ranging from "traces" to 0.0139 per cent. As_2O_3. The question of danger to the consumer is not settled, but it is thought that no serious injury can result from the use of arsenites. Data as to the best time for spraying, the amount to use, and the quantity received by each plant, are also given.

Report of the Section on Agriculture and Chemistry. *Proc. Ninth Ann. Convention Assoc. Am. Agr. Coll. Exp. Sta., U. S. Dept. Agr., Bull.* 30, 10–14.—This bulletin gives a short summary of the work of the several experiment stations, during the year 1896, in agricultural and chemical studies.

Bordeaux Mixture, Its Chemistry, Physical Properties, and Toxic Effects on Fungi and Algae. By W. T. Swingle. *U. S. Dept. Agr., Div. Vegetable Physiology and Pathology, Bull.* 9.—Bordeaux mixture is said to be a mixture of calcium sulphate and cupric hydroxide, suspended in an aqueous solution of calcium sulphate and calcium hydrate. When freshly made, the cupric hydrate is of a colloidal nature, but on standing it becomes crystalline. The copper, even when in a very dilute condition, exerts a very destructive action on the germinating power of fungus spores and upon algae.

The Real Value of "Natural Plant Food." By L. L. Van Slyke. *N. Y. Agr. Exp. Sta., Bull.* 108.—The article is a warning against a certain fertilizer manufactured by the Natural Plant Food Co., of Washington, D. C. Analysis of the material shows it to be a very inferior article.

Analyses of Commercial Fertilizers. *Agr. Expt. Sta. Bull., Ga. Dept. Agr., No.* 32; *Ky., Nos.* 60 and 64; *Mass. Hatch Sta., No.* 42; *Me., Nos.* 22 and 30; *N. C., Special Bull. Nos.* 37 and 38; also *Bull.* 124; *N. J., No.* 113; *N. Y., Nos.* 96 and 107; *Pa. Dept. Agr., No.* 11; *Purdue Univ., Special Bulls., May and August, 1896; R. I., No.* 34; *W. Va., No.* 40; *Md., No.* 40.

W. R. WHITNEY, REVIEWER.

Reduction of Nitrates by Bacteria and Consequent Loss of Nitrogen. By Ellen H. Richards and George William Rolfe. *Tech. Quart.*, 9, 40–59. The authors found that the nitrogen of potassium nitrate, in water containing a tenth of a per cent. of milk was in some way lost in the cycle of changes: nitrate, albuminoid ammonia, free ammonia, nitrite, nitrate, after entering the nitrite stage. Investigation showed that the organisms growing in the solution generated nitrogen gas during their growth, and that practically all of the previously missing nitrogen of the nitrate was thus accounted for. The article concludes with some interesting suggestions concerning the storage of nitrogen in soils and waters.

The Excretion of Metabolized Nitrogen by Animals. By C. F. Langworthy. *U. S. Dept. Agr. Exp. Sta. Record*, 7, 817–825. —This article is a summary of the principal results of other experimenters upon the part played by nitrogen in the nutrition of animals.

On the Behavior of Coal-Tar Colors toward the Process of Digestion. BY H. A. WEBER. *J. Am. Chem. Soc.*, 18, 1092–1097.—The digestive actions of pepsin and pancreatin when acting upon fibrin, in the presence of oroline yellow, saffoline, magenta, and methyl orange, were separately studied. Of these colors only oroline yellow retarded the action of the pepsin; but saffoline, magenta, and methyl orange interfered very seriously with the fermenting action of pancreatin. The use of such colors in articles of food and drink is therefore objectionable.

The Formation of Fat in the Animal Body. BY SELIK SOSKIN. *U. S. Expt. Sta. Record*, 18, 179–192.—This article gives a historical account of investigation since 1742, made to discover the source of the fat in the animal body. It concludes with the acceptance of Pflüger's results and conclusions as opposed to those of Pettenkoffer and Voit, who believed that fat could be produced in the animal system from proteids alone.

E. H. RICHARDS, REVIEWER.

Food and Nutrition Investigations in New Jersey in 1895 and 1896. BY EDWARD B. VOORHEES. *U. S. Dept. Agr. Exp. Sta., Bull.* 35, 7–40.—This report deals mainly with the composition and cost of bread and of milk. Analyses are given of 139 samples of fresh bread and of 108 samples of milk. The work done on bread shows that while wheat and wheat flour may be considered as standard articles, bread made from the same flour may have a varying nutritive value. The results of a dietary study of a mechanic's family are also recorded.

Milk Fat and Cheese Yield. BY L. L. VAN SLYKE.—*N. Y. Agr. Expt. Sta., Bull.* 110, 251–280.—The author presents the results of a very large number of determinations of the relation of the amount of fat to the amount of casein in milk and to the yield of cheese obtained from it. Milk from fifty different herds of cows was examined during a period of six months. The experiments show that *in general* milk fat and casein increase simultaneously; but that the increase of the former is usually relatively greater than that of the latter. This is shown by the following table, in which are given the general averages for milks containing 3 and 4 per cent. of fat, respectively:

Per cent. fat.	Per cent. casein.	Ratio of casein to fat.	Percentage yield of cheese.	Ratio of cheese yield to fat.
3.00	2.10	0.70	8.55	2.85
4.00	2.40	0.60	10.40	2.60

Although the ratio of cheese yield to fat is somewhat greater in the case of the milks poorer in fat, yet the quality of cheese produced is proportionately poorer, so that the author concludes from these results that milk fat forms the fairest practicable basis to use in paying for milk for cheese making—that in no case should it be paid for by weight of milk alone, and that payment by cheese yield gives an unfair advantage to poor milk.

Analyses of Some Substances Sold as Cream of Tartar. By G. F. Payne. *Ga. Dept. Agr.*, *Bull.* **32**, 24–28.—Of ten samples purchased and analyzed, five contained no cream of tartar, two contained less than 57 per cent., and one less than 80 per cent.

The Study of Human Foods and Practical Dietetics. By M. E. Jaffa. *Univ. Cal. Agr. Expt. Sta.*, *Bull.* **110**, 3–19.—The title is sufficiently descriptive of the general character of this bulletin. It is for the most part based upon previously published work; but it contains the following valuable results, expressed in per cent., calculated from original analyses of California fruit, nuts, and bread stuffs.

	Water.	Total nutrients.	Protein.	Fats.	Carbohydrates.	Mineral matters.	Fuel value of one ounce.
Wheat flour	12.5	87.5	8.0	1.1	77.9	0.5	102
Graham flour	12.1	87.9	8.5	1.9	75.8	1.5	103
Bread	32.3	67.7	6.4	1.7	58.7	0.9	80
Apples	83.2	16.8	0.2	0.4	15.9	0.3	20
Oranges	88.0	12.0	0.8	11.2		..	14
Prunes (all)	80.0	20.0	0.8	18.7		0.5	23
Apricots	85.0	15.0	1.0	13.5		0.5	18
Figs	79.0	21.0	1.5	18.9		0.6	24
Grapes	80.0	20.0	1.3	18.2		0.5	23
Olives	58.0	42.0	1.1	27.6	11.6	1.7	88
Walnuts	2.5	97.5	14.3	65.9	16.3	1.0	202
Almonds	5.3	94.7	17.6	56.2	19.1	1.8	191
Peanuts	8.0	92.0	28.0	40.0	23.0	2.0	164

APPARATUS.

A. H. GILL, REVIEWER.

A New Form of Potash Bulb. By M. Gomberg. *J. Am. Chem. Soc.*, **18**, 941. The bulb is shaped like a small Erlenmeyer flask and divided into three compartments. It is much less fragile than the usual form; and it will stand upon the balance pan. It is, however, difficult to manufacture; and whether it presents a sufficient surface for absorption is questionable.

A Rapid Measuring Pipette. By E. L. Smith. *J. Am. Chem. Soc.*, **18**, 905.—The apparatus described seems to be fairly accurate, to admit of rapid work and to be easily made.

A Simple and Convenient Extraction Apparatus for Food Stuff Analysis. By J. L. Beeson. *J. Am. Chem. Soc.*, **18**, 744–745. The apparatus is an adaptation of the Johnston extractor, this being provided with a ground-glass stopper, which is closed with a rubber cap while weighing. The stopper is funnel shaped, and during the extraction it is inverted in the extraction tube, thus directing the solvent to the center of the sample and preventing loss by spattering.

On a Simple Automatic Sprengel Pump. By B. B. Boltwood. *Am. Chem. J.*, **19**, 77–78.—The apparatus makes use of a water jet pump to draw the mercury through the Sprengel tube. In course of ten minutes operation vacua suitable for the display of electrical phenomena are obtained.

On Some New Forms of Gas Generators. By T. H. Norton. *J. Am. Chem. Soc.*, **18**, 1057–1061.—The article shows how common laboratory apparatus may be utilized for this purpose.

A Modified Form of the Ebullioscope. By H. W. Wiley. *J. Am. Chem. Soc.*, **18**, 1063–1067.

A New Electrolytic Generator for Oxygen and Hydrogen. By W. S. Franklin. *Phys. Rev.*, **4**, 61.—The generator consists of a number of massive frames of an alloy of lead with four per cent. of antimony, bolted together and insulated from each other by rubber diaphragms. The gases are prevented from mixing by glass strips. The generator requires 19 volts per cell, the current through each cell being 24.6 amperes. The maximum purity of the hydrogen was 94.8 per cent.; that of the oxygen 86.2 per cent. The efficiency of the generator is about 36 per cent. It gives 660 liters of hydrogen and 330 liters of oxygen per hour, at a cost of about 80 cents, which is 8 cents per cubic foot of oxygen.

The Practical Use in the Chemical Laboratory of the Electric Arc Obtained from the Low Potential Alternating Current. By M. S. Walker. *Am. Chem. J.*, **18**, 323–328.—The arc may be used: (1) To show the effect of high temperatures upon difficultly fusible and volatile substances; (2) for the reduction of metallic oxides; (3) blowpipe analysis; and (4) for the preparation of some compounds of carbon from the elements. The article describes the apparatus and methods to be employed in these various applications.

A New Form of Pyknometer. By J. C. Boot. *J. Am. Chem. Soc.*, **19**, 61–62.—The usual bottle form is vacuum jacketed to prevent the troublesome expansion of the liquid during weighing and its outflow through the capillary.

Apparatus for the Electrolysis of Hydrochloric Acid. BY GEO. O. HIGLEY AND B. T. HOWARD. *Am. Chem. J.*, 18, 587. The apparatus is a modification of that of Hofmann, so arranged that the hydrogen and chlorine are generated in separate vessels and traverse but a small layer of liquid. It is said to be very simple and accurate.

Apparatus for Distillation in a Vacuum. BY P. C. FREER. *Am. Chem. J.*, 18, 584.—A modification of the Kahlbaum receiver, so arranged that the entire top can be covered with mercury, thus effectually preventing leakage.

Apparatus for Showing the Composition of Water. BY P. C. FREER. *Am. Chem. J.*, 18, 584.—A modification of the Hofmann apparatus so arranged that the explosion can take place under diminished pressure and prevent the shattering of the tube.

METALLURGICAL CHEMISTRY.

H. O. HOFMAN, REVIEWER.

A Hot-Blast System for Copper Matting and Silver-Lead Furnaces. BY J. A. NESMITH. *Min. Sci. Press*, 73, 318.—The air on its way from the blower to the blast furnace passes through a chamber in which a jet of oil or gas is kept burning. The products of combustion become mixed with the air, superheat it, and pass off with it. The reason for allowing a mixture of carbon dioxide and air to enter the furnace is that the air having been superheated is more active and less of it is required in the blast furnace for oxidizing the fuel; hence dilution with carbon dioxide has no bad effect. On the other hand superheated air of such a composition will not have the tendency to localize the heat as would superheated pure air, but will distribute it. It seems to the reviewer that this method of working is not based upon correct principles. If the blast is to be superheated by the combustion of extraneous fuel, why undo the good effect by diluting with carbon dioxide? If the effect of the air superheated in the usual way is too strong, cut down the coke in the blast furnace, and this will weaken it in an economical way. Blowing large volumes of weak air through a furnace can only have the effect of making the heat creep up and give a hot top. While perhaps desirable in pyritic smelting, this is fatal to lead smelting. It would appear as if the relative prices of coke and of bituminous coal, oil, or gas would have to decide whether the blast is to be superheated or not; but if superheated, the products of combustion must be kept separate from the blast furnace air.

The Percentage of Zinc in Slags. BY E. A. WEINBERG. *Eng. Min. J.*, 57, 580.—The paper gives some facts obtained by the author in smelting roasted sulphide lead ore, rich in zinc, in a small water-jacket blast furnace. The best slag made contained: SiO_2, 32 per cent., FeO, 31; CaO, 7; Al_2O_3, 8.5, ZnO, 18.5; the rest being lead, copper, sulphur, and alkali; the matte assayed as high as 22 per cent. of zinc and was very rich in lead and copper.

Granulating Matte. BY S. E. BRETHERTON. *Eng. Min. J.*, 63, 43.—This is a short note outlining the method of granulating blast furnace matte at the works of the American Smelting Co., Leadville, Col. Granulated matte appears to roast more easily than when it has been crushed, rolled and screened, as is the common practice; further, granulating is much cheaper than any other method of comminuting.

Wall Accretions of Lead Blast Furnaces. BY M. W. ILES. *School Mines Quart.*, 18, 18–23.—This is a brief discussion of how wall accretions are formed in the lead blast furnace, what their general character is, and how their formation may be lessened, as it is not possible to avoid them entirely. An average analysis gave the following figures: SiO_2, 17.26; Fe, 13.26; Mn, 1.60; CaO, 3.20; S, 10.90; Zn, 18.42; Cu, 0.80; an average of all the assays made at the works under the author's charge in seventeen years: Pb 24.06 per cent., Ag 29.74 ounces and Au 0.197 ounce per ton. Wall accretions are formed mainly by the volatilization and condensation of metallic sulphides; these are often oxidized to some extent after deposition. The other constituents are particles of the charge that have during the descent become mechanically lodged in the accretion and may have undergone a chemical change later. For the practical details the reader is referred to the paper.

The Calculation of Copper-Matte Blast Furnace Charges. BY H. VAN F. FURMAN. *School Mines Quart.*, 18, 1–13.—As in a previous paper on a calculation of lead blast furnace charges, (*op. cit.*, 14, 134–148,) the author discusses first the general principles and then illustrates them by carrying out calculations in detail. The leading principles are that (1) the slag produced shall be good from a metallurgical and economical point of view, the range of composition being: SiO_2, 26–45; Al_2O_3, 0–20; FeO, 28–65; CaO, 0–28; ZnO, 0–14; and of specific gravity 3.50–3.75; (2) the different ores shall be used up in about the same proportions as they are received; (3) the matte shall be of a proper grade for further treatment, 50 per cent. of copper being a common figure; (4) the percentage of sulphur, arsenic, and antimony volatilized in the blast furnace, from 8 per cent. in ordinary matting to 90 per cent. in true pyritic smelting, shall be taken into consideration; (5) the chemical composition of the matte shall be ascertained; for, besides all the copper, three-fourths of the lead and one-half of the zinc enter it, the rest of the available sulphur combining with iron; (6) the total weight of the charge shall bear a certain relation to the size and working of the blast furnace, the figures varying from 2000 to 4000 pounds; (7) the percentage of fuel shall be correctly apportioned, from 10 to 15 per cent. of coke, (12 per cent. ash), if little sulphur is oxidized, the percentage being on the sum of ore and flux; (8) the loss in gold, silver and copper shall not exceed permissible amounts, *viz.*, loss in gold *nil*, in silver 95 per cent.; with 40–50 per cent. matte the slag shall not contain over 0.6 per cent. copper. Three examples show how these general considerations are followed under special conditions.

Improvements in the Electrolytic Refining of Copper. By T. Ulke. *Eng. Min. J.*, **62**, 464–565. The author states that it is generally conceded now that the Farmer or Hayden process (arranging the plates in series without separate cathodes) is less satisfactory than the common multiple process and that the former is no longer used to any extent except at the works of the Baltimore Electric Refining Co. He further describes the method of circulating the electrolyte in use at the copper refining works of M. Guggenheim's Sons, at Perth Amboy, N. J., which is a slight modification by Schneider and Szontag of the one used for many years by Borchers Bros., Goslar, Prussia (see Borchers, Electrometallurgie, 1895, p. 185).

Present Method of Treating Slimes from Copper Refineries. By T. Ulke. *Eng. Min. J.*, **62**, 512.—The slimes from electrolytic copper refineries, amounting to about 4 per cent. of the weight of the anode, contain, after the scrap copper has been screened off, 15–30 per cent. copper, 45–50 per cent. silver, less than 1 per cent. gold, and 20–35 per cent. of impurities, made up of lead, bismuth, arsenic, antimony, and tellurium. In some works, which have a lead plant in addition to a copper plant, the slimes are added either to the softening furnaces treating comparatively low-grade blast furnace lead or to the cupelling furnaces working the enriched lead. In other plants the slimes are first refined in the wet way and then in the dry way. Thus, at the Baltimore Electric Refining Co's works the screened slimes are boiled for three or four hours in dilute sulphuric acid (1 : 4) using a Körting injector, dried, melted down, and refined in a cupelling furnace. In the furnace at first a brownish slag with 20 per cent. lead and 10 per cent. antimony forms on the surface; it is drawn, cooled, picked over for prills of silver, and worked off with lead in a separate cupelling furnace. Then niter is spread over the precious-metal bath in the furnace, which refines the metal, forming a second slag, to be drawn off, containing as much as 20 per cent. tellurium. The doré silver is now ready to be cast into bars for parting.

The Separation of Nickel and Copper in Matte and the Recovery of the Contained Precious Metals. BY T. ULKE. *Eng. Min. J.*, 63, 113–114.—The author gives a brief review of a number of processes for treating nickel-copper matte in the wet way, and a short outline of an electrolysis method of his own. Electrolytic refining of matte has so far always been a failure, and the method proposed does not show, as far as can be judged from the details given, why it should not share the same fate as its predecessors.

The Brown Patent Automatic Pulp Distributor. BY H. P. BROWN. *Eng. Min. J.*, 62, 512–513.—This article refers to a simple mechanical devise for distributing the pulp cheaply, evenly, and loosely in the large leaching tanks (diameter 24–26 feet, depth 5–6 feet) of gold and silver mills.

Purification of Sodium Hyposulphite Solutions. BY A. R. P. *Eng. Min. J.*, 63, 63.—The author calls attention to the good results obtained in leaching silver ores with sodium hyposulphite after having freed this solvent from sodium sulphate by acidulating and over-precipitating with calcium sulphide. In regular work he uses sodium sulphide to precipitate the metals, and at the same time to convert sodium tetrathionate (formed in making Russell solution) into hyposulphite, he then follows this up by using calcium sulphide to eliminate obnoxious sodium sulphate as harmless calcium sulphate. It may be recalled in this connection that Ottokar Hofmann has always advocated the use of sodium hyposulphite as a solvent in combination with calcium sulphide as precipitant.

The Cyanide Process. BY A. D. NORDHOFF. *Min. Sci. Press*, 73, 441.—A complete list of the books and papers on the subject contained in the library of the University of California.

The Cyanide Process for the Treatment of Gold Ores. BY J. W. RICHARDS. *J. Franklin Inst.*, 143, 96–109.—This paper is a short review of the MacArthur–Forrest process, giving its development and chemistry, and describing some of the work that is being done in treating telluride ores in Colorado and native gold ores in Utah and the Transvaal.

[CONTRIBUTION FROM THE MASSACHUSETTS INSTITUTE OF TECHNOLOGY.]

REVIEW OF AMERICAN CHEMICAL RESEARCH.

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ARTHUR A. NOYES, Editor; HENRY P. TALBOT, Associate Editor.

REVIEWERS: Analytical Chemistry, H. P. Talbot and W. H. Walker; Biological Chemistry, W. R. Whitney; Carbohydrates, G. W. Rolfe; General Chemistry, A. A. Noyes; Geological and Mineralogical Chemistry, W. O. Crosby; Inorganic Chemistry, Henry Fay; Metallurgical Chemistry and Assaying, H. O. Hofman; Organic Chemistry, J. F. Norris; Physical Chemistry, H. M. Goodwin; Sanitary Chemistry, E. H. Richards; Technical Chemistry, A. H. Gill and F. H. Thorp.

METALLURGICAL CHEMISTRY.

H. O. HOFMAN, REVIEWER.

The Cyanide Process. BY R. P. ROTHWELL. *Eng. Min. J.*, 62, 386.—In this country the cyanide process was first successfully carried out at the Mercer Mine, Camp Floyd district, Utah. The gold occurs there in limestone, and a high extraction is readily obtained with coarse ore. Usually ore has to be crushed through a 40-mesh screen, with the result that fully 50 per cent. of it can then be passed through a 100-mesh sieve, and such fine ore leaches slowly. If the pulp shows, in panning, particles of gold as coarse as the mesh-aperture, an exposure of a week to the solvent action of potassium cyanide has been found necessary to effect a satisfactory extraction. The ore best suited for cyaniding is one that is neutral or slightly alkaline and free from or very low in copper. Leaching telluride ores raw has not been satisfactory, the results varying greatly without any apparent cause. The reason is probably to be found in the different behavior of the tellurium minerals, sylvanite, petzite, calaverite, and hessite, with potassium cyanide. At present tellurides are roasted before leaching; roasting can be carried on without an appreciable loss of gold by volatilization, but the gold is liable to be left in the form of smooth globules not readily attacked by cyanide; furthermore, the ore must be dead-roasted, as neutralizing the ore with a wash of caustic soda has been found in many cases to reduce the extraction. In making laboratory experiments to serve as a basis for planning a mill, chemical tests ought to be supplemented by sizing-tests to show the subdivision of the gold in the pulp, and by microscopical examination to show the form in which it is present.

Electrolytic Precipitation of Gold from Cyanide Solutions. By S. Croasdale. *Eng. Min. J.*, **62**, 57.—The paper is a record of a number of experiments carried out on a sufficiently large scale to allow the results to serve as a basis for industrial work. Amalgamated zinc, the most positive of the available metals, was used as the electro-positive, sheet lead as the electronegative, pole. The current ranged from 0.04–0.05 amperes per square foot, the voltage was low, and the flow of solution such that the gold from half a pound of solution was deposited in 30 seconds on each square foot of depositing surface. A standard solution with 12.787 milligrams gold per liter gave up 98.04 per cent. of the gold; with a dilute solution of 1.84 grams gold per liter, the capacity had to be doubled to obtain an extraction of 93.48 per cent., the loss of cyanide from the 0.65 per cent. solution was only 2.845 per cent., and the solution from the precipitating vat was very active in dissolving gold. In using lead anodes as well as cathodes, the current had to be raised from 0.04 to 0.2 ampere per square foot, when much gas was set free and the solution, as it came from precipitating vat, was inactive though it became active after standing. The recovery of gold was 94.34 per cent., and the loss in cyanide 5.15 per cent.

A New Gold-Saving Process. By P. Langhammer. *Min. Sci. Press*, 73, 316.—The innovation consists in drying, sizing, and stirring the ore, which is said to detach the films of gold and make them amenable to the solvent, potassium cyanide, which is to be applied separately to each size.

The Value of the Pyrometer in the Down Comer. By E. A. Uehling. *Am. Manufacturer and Iron World*, 60, 115–117.—The writer calls attention to the importance of measuring in an iron blast furnace not only the temperature of the blast, but also that of the gas passing off through the down comer, which corresponds to from 5 to 8 tons for every ton of pig made and carries with it from 40 to 75 per cent. of the total heat energy contained in the fuel. Two temperature charts autographically recorded by the Uehling and Steinbart pneumatic pyrometer are given, each showing the temperatures of blast and of gas. One record represents the furnace in good condition, making 146 gross tons of good foundry iron with 147 gross tons of coke, the blast temperature ranging from 1000° to 1100° F. (average 1050°), and the gas temperature from 300° to 500° F. (average 400°); the other, when working unsatisfactorily, *viz.*, 129.5 gross tons of iron of inferior quality, with 171 gross tons of coke, blast temperature 1000°–1200° F., gas temperature 700°–800° F. By calculation the author finds that in the case given 50 per cent. more gas was evolved with the higher than with the lower temperature, which corresponds to 730 and 296 pounds of carbon per ton of iron made.

INORGANIC CHEMISTRY.

HENRY FAY, REVIEWER.

Action of Water of the Hubb Coal Mine upon Cast Iron. BY FRANK W. DURKEE. *Am. Chem. J.*, **18**, 849–858.—The author has examined samples of cast iron which had lain twenty-three years under water in the Hubb Coal Mine in Cape Breton, Nova Scotia, and has found that, while retaining its shape, it had materially altered in properties. The pieces were soft enough to be easily cut with a knife, and very brittle. A cross section showed an inner, softer part, lighter in color than the outer part. The transformed cast iron was magnetic, porous, and several times lighter than the same bulk of cast iron. Wrought iron which had been used in the mine was deeply corroded on the surface, but the interior was unaffected. The following figures, representing the average composition of the altered portion, were obtained by analysis: SiO_2, 12.25; Si, 1.67; C, 13.33; H_2O mechanically held, 3.53; H_2O combined, 5.21; FeS, 0.38; SO_3, 2.73; P_2O_5, 1.65; CaO, 1.25; MgO, 0.35; MnO, 0.30; FeO, 34.29; Fe as metallic iron and in the carbide Fe_3C, 23.06. Specific gravity, 2.5 The water in the mine was examined and found to contain in grams per liter: free and combined H_2SO_4, 0.4551; free H_2SO_4, 0.0230; Ca, 0.0419; Mg, 0.0222; SiO_2, 0.0153; Cl, 0.0284; As, 0.00005; Fe, Al, and Mg, 0.0096.

Experiment with Gold. BY M. CAREY LEA. *Am. J. Sci.*, **153**, 64.—On reducing some gold solutions with sodium hypophosphite the author noticed in special cases an emerald green color. This color is best produced by bringing together 15 cc. of a ten per cent. sodium hypophosphite solution, one cc. of gold chloride solution containing 0.10 gram of metallic gold and one drop of sulphuric acid. When the solution begins to darken 30 cc. of water are added. The solution now assumes a green transparent color, gradually becoming cloudy. If it is now filtered, it again becomes green and cloudy. This process can be repeated several times. The green color is due to a very small quantity of finely divided bluish-black metallic gold suspended in the yellow liquid.

Silver Hydride. BY EDWIN J. BARTLETT AND WM. F. RICE. *Am. Chem. J.*, **19**, 49–52.—Silver hydride, AgH, was prepared by precipitating a dilute solution of silver nitrate with dilute hypophosphorous acid in excess. The solution becomes wine-colored at first, changing to black, and after a few minutes black, spongy flakes are precipitated, which are filtered at once. The filtrate, on long standing or boiling, deposits metallic silver. Silver hydride is not decomposed by water.

Silicide of Chromium. By G. de Chalmot. *Am. Chem. J.*, **19**, 69–70.—Chromium silicide, Si_2Cr, was obtained by heating together in an electric furnace silica, charcoal, and chromium sesquioxide. It crystallizes in long, gray needles having a metallic luster; it is not attacked by cold hydrochloric acid or aqua regia, but dissolves in hydrofluoric acid. A sufficient quantity of pure crystals was not obtained for analysis, but the composition was determined in two specimens, to which some free silicon adhered. The specific gravity is 4.393.

Action of Ferric Chloride on Metallic Gold. By Parker C. McIlhiney. *Am. J. Sci.*, **152**, 293–294.—The author, in testing the solubility of metallic gold, found that it is not soluble in concentrated hydrochloric acid when heated in a pressure tube at 150° C, nor in ferric chloride in absence of oxygen; but in presence of oxygen ferric chloride acts as a chlorine carrier, and dissolves appreciable quantities of gold.

Silicides of Copper and Iron. By G. de Chalmot. *Am. Chem. J.*, **19**, 118–123.—In a former article (*This Rev.*, **2**, 7) the author described a copper silicide of the formula Cu_2Si_2. Vigoureux has already made it appear improbable that any other copper silicide than Cu_2Si exists. The author has repeated his work, and concludes that while some crystals analyzed by him seem to have the composition represented by the formula Cu_2Si_2 there are present in these crystals both free silicon and free copper, and that the silicide present has in reality the formula Cu_2Si. This is, the author thinks, a case of chemical equilibrium between copper silicide and its decomposition products, copper and silicon. Contrary to the statement of Vigoureux, it is shown that copper silicon alloys containing up to 20 per cent. of silicon do contain free silicon. The author has established the existence of an iron silicide having the composition represented by the formula $FeSi_2$. By treating an iron silicon alloy containing about 39 per cent. of silicon with cold hydrofluoric acid, to which water was added, from time to time, there was left a residue of gray metallic crystals, which had the composition $FeSi_2$. The silicide is completely soluble in cold hydrofluoric acid, especially if the acid is concentrated, but is less soluble than the iron silicides containing less silicon.

Drying and Deliquescence of Certain Salts. By F. W. Smither. *Am. Chem. J.*, **19**, 227–232.—Definite quantities of lithium, calcium, and magnesium chlorides, and of calcium and magnesium nitrates were mixed with powdered glass and dried at a temperature of 97°–98° C. during six hours a day for thirty days, weighings being made daily. Each portion was dried in a desiccator over night, and in some cases moisture was absorbed from the calcium chloride of the desiccator, so that comparable results were not obtained; furthermore the magnesium salts lost acid after heating for some days. To test the absorption of water by the same salts dried quantities were placed in beakers together with a piece of lampwick, which helped to expose the salt to a greater surface. The beakers were placed in a bell-jar containing water and were weighed almost daily for seven weeks and thereafter weekly for five weeks. The results are tabulated together with calculations of the number of molecules of water absorbed, from which it appears that no definite degree of hydration took place.

Metal Separations by Means of Hydrochloric Acid Gas. BY G. BIRD MOYER. *J. Am. Chem. Soc.*, 18, 1029–1044.—The author has converted the oxides of antimony, bismuth, copper and lead quantitatively into chlorides by heating them in a current of hydrochloric acid gas. With ferric oxide some reduction took place. By the volatility of the chlorides of bismuth and antimony he has separated them from copper and lead, and by the volatility of arsenic trichloride he has separated the arsenic from the arsenates of silver, copper, cadmium, cobalt and nickel. The mineral niccolite, dissolved in nitric acid and evaporated to dryness, is readily freed from arsenic by this method.

The Action of Acid Vapors on Metallic Sulphides. BY JEROME KELLEY, JR. AND EDGAR F. SMITH. *J. Am. Chem. Soc.*, 18, 1090–1098.—Arsenic, antimony, and stannic sulphides are converted into the chlorides by heating in a current of hydrochloric acid gas; stannous sulphide is also converted into the chloride, but cannot be volatilized. The dry sulphides of arsenic and antimony are completely volatilized when exposed to hydrobromic acid gas.

Tungsten Hexabromide. BY HERBERT A. SCHAEFFER AND EDGAR F. SMITH. *J. Am. Chem. Soc.*, 18, 1098–1100.—Tungsten hexabromide, consisting of blue black crystals, was prepared by heating tungsten in a current of bromine diluted with nitrogen. It fumes in the air, and is decomposed by water into a blue oxide.

Note on the Ferrocyanides of Zinc and Manganese. BY EDMUND H. MILLER. *J. Am. Chem. Soc.*, 18, 1100–1102.—This paper is a preliminary note relating to the composition of these salts.

Analysis of an Iron Rail Taken from a Gallery of an Unused Coal Mine. By Henry P. Talbot and A. G. Woodman. *J. Am. Chem. Soc.*, 19, 9–12.—This article gives the results of the analysis of a cast iron rail which had lain twenty-three years under water in the Hub Mine, at Glace Bay, Cape Breton. It was composed of an inner and outer portion, the densities of which seemed to increase with length of exposure to the air. The results are compared with those of Herting (*Chem. Ztg.*, 20, 54), who analyzed a similar rail. (See also above, this *Rev.*, 3, 51.)

The Oxalates of Zirconium. By F. P. Venable and Charles Baskerville. *J. Am. Chem. Soc.*, 19, 12–18.—Basic oxalates of zirconium were formed by precipitation. It was found impossible to obtain the neutral oxalate. The acid oxalate $Zr(C_2O_4)_2.H_2C_2O_4.8H_2O$, and the following double oxalates were prepared:

$$Zr(C_2O_4)_2.3Na_2C_2O_4.H_2C_2O_4.5H_2O,$$
$$[Zr(C_2O_4)_2]_2.(K_2C_2O_4)_2.H_2C_2O_4.8H_2O,$$
$$Zr(C_2O_4)_2.2(NH_4)_2C_2O_4.$$

Preparation of Sodium Nitroprusside. By F. S. Hyde. *J. Am. Chem. Soc.*, 19, 23–24.—Detailed directions for the preparation of pure sodium nitroprusside are given in this paper.

Some Peculiar Forms of Iron. By T. H. Norton. *J. Am. Chem. Soc.*, 19, 108–110.—A mass of pig iron which had been in the molten condition for over a year was analyzed and found to be practically pure iron, except for a high percentage of phosphorus—0.828. It was extremely hard, malleable, and crystalline, showing rectangular cleavage.—The support for the mantle of a Welsbach burner was found to be extremely brittle, crumbling easily. Analysis showed 0.097 per cent. carbon, while the original steel contained 0.642 per cent.

A Tungsten-Iron Alloy. By T. H. Norton. *J. Am. Chem. Soc.*, 19, 110.—Analysis of a hard and brittle tungsten-iron alloy of specific gravity 14.55, showed 93.43 per cent. tungsten and 6.18 per cent. iron.

Our Present Knowledge of Argon. By C. LeRoy Parker. *J. Am. Chem. Soc.*, 19, 124–138.—This paper contains nothing original, but is a review of our knowledge of argon, to which is added a valuable bibliography.

On the Volatility of Certain Inorganic Salts. By T. H. Norton and D. M. Roth. *J. Am. Chem. Soc.*, 19, 155–166.—The authors have examined the volatility of borax, of sodium and potassium fluorides, and of barium chloride. The results are tabulated and compared with the time it takes to volatilize

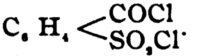
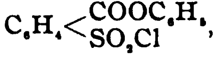
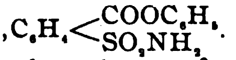
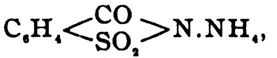
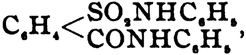
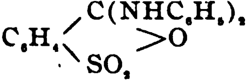
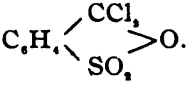
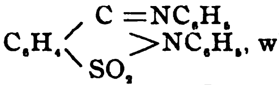
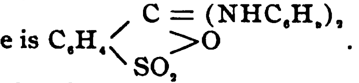
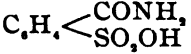
0.01 gram sodium chloride in the hottest part of the Bunsen flame.

H. P. TALBOT, REVIEWER.

On the Volatility of Ferric Chloride. BY HENRY P. TALBOT. *Am. Chem. J.*, 19, 52–59.—The experimental data show that no loss of ferric chloride occurs, when its solutions (whether neutral or acidified with hydrochloric acid) are evaporated to dryness on the water-bath or upon the hot plate, provided in the latter case they are not too strongly overheated. The residues so obtained were subjected to the temperature usually employed to dehydrate silicic acid (130° C.) for two hours, but suffered no loss of iron. Prolonged heating of these residues over a free flame occasioned but a slight loss (0.4 per cent.) of the iron present. Concentrated acid solutions of the chloride, when boiled in a distilling flask, allowed ferric chloride to pass into the receiver only when a slight separation of the solid had taken place on the side of the flask, which, in the acid atmosphere, was volatilized by the overheating of the glass. When ferric chloride solutions are evaporated with exposure to the air, a loss of chlorine ensues, and the basic ferric salt formed prevents loss of the iron as chloride. The presence of ammonium chloride with the ferric chloride occasioned no loss of the latter, even at 130° C. The residues, when heated over a free flame, suffered a loss of iron, as would be expected. The presence of aqua regia with the ferric chloride solution tends to occasion a slight loss of iron during evaporation. The maximum loss was 0.6 per cent. of the iron present, but in other cases very little or no loss could be detected. Vogel's experiments (*N. Rep. Pharm.*, 18, 157) were repeated, and it was found that a slight volatilization of iron seems to take place from an ethereal solution at the temperatures of the laboratory, but, on the other hand, the presence of ether or its vapor does not promote the volatilization of the ferric chloride from its boiling, concentrated, aqueous solutions.

ORGANIC CHEMISTRY.

J. F. NORRIS, REVIEWER.

Investigations on the Two Isomeric Chlorides of Orthosulphobenzoic Acid. BY IRA REMSEN. **IV. Purification of the Chlorides and Action of Various Reagents upon Them.** BY IRA REMSEN AND S. R. MCKEE. **V. The Relation of the Anilides.** BY IRA REMSEN AND J. R. HUNTER. **VI. Orthocyanbenzenesulphonic Acid.** BY IRA REMSEN AND W. J. KARSLAKE. *Am. Chem. J.*, 18, 791–829.—In earlier articles (*Am. Chem. J.*, 17, 309–347; *Tech. Quart.*, 8, 194) the preparation and properties of the two isomeric chlorides of orthosulphobenzoic acid were described, and evidence was presented which shows that the chloride melting at 79–79°.5 has the structure  $C_6H_4<\begin{matrix}COCl\\SO_2Cl\end{matrix}$. The reactions of the carefully purified chlorides with various reagents and the resulting compounds have been studied, and additional evidence in favor of the unsymmetrical structure for the low-melting chloride furnished. (IV.) To obtain the high melting chloride in pure condition, an ethereal solution of the mixed chlorides is evaporated to crystallization, after being shaken with dilute ammonia, which transforms the low-melting chloride into the ammonium salt of cyanbenzenesulphonic acid. The pure low-melting chloride (m. pt. 21°.5–22°.5) is obtained by fractional crystallization at 0° of the mixed chlorides from carefully purified ligroïn boiling at 90°–125°. Water decomposes the low-melting chloride about three times as fast as the high-melting chloride. 65 per cent. of the former was changed to acid after standing four days at the ordinary temperature. Both chlorides give the same products when heated with phenol; *viz.*, the diphenyl ester of orthosulphobenzoic acid and a compound, probably of the structure  $C_6H_4<\begin{matrix}COOC_6H_5\\SO_2Cl\end{matrix}$, which is changed by dilute ammonia into phenyl orthosulphaminebenzoate,  $C_6H_4<\begin{matrix}COOC_6H_5\\SO_2NH_2\end{matrix}$. The diphenyl ester was saponified when heated at 200°, with concentrated hydrochloric acid, and was transformed into the ammonium salt of benzoic sulphinide,  $C_6H_4<\begin{matrix}CO\\SO_2\end{matrix}>N.NH_4$, when heated at 125° for four hours with ammonia. With resorcinol both chlorides gave the same sulphonfluorescein. When the high-melting chloride was treated with aniline, only the fusible anilide,  $C_6H_4<\begin{matrix}SO_2NHC_6H_5\\CONHC_6H_5\end{matrix}$, (m. pt. 194°–195°) was obtained. The low-melting chloride yielded a mixture of equal amounts of the above compound and the infusible anilide,  which melts at 250°–270° with decomposition. With ammonia the high-melting chloride gives the ammonium salt of benzoic sulphinide, while the low-melting chloride gives the ammonium salt of orthocyanbenzenesulphonic acid. The latter transformation is additional evidence in favor of the unsymmetrical structure for the low-melting chloride,  When the latter compound was dissolved in ether and shaken with dilute ammonia, it was in part, changed into the high-melting chloride. By the action of benzene and aluminum chloride on the low-melting chloride the same compounds were formed which had been obtained by Remsen and Saunders (*loc. cit.*) from the high-melting chloride; namely, orthobenzoylbenzenesulphonchloride and orthobenzoyldiphenylsulphone. It was impossible to change the low-melting chloride into its isomer by heating in a sealed tube at 90°, or by shaking with water for half an hour. (V.) The two anilides of orthosulphobenzoic acid were prepared by the action of an ethereal solution of aniline on the mixed chlorides. By crystallization from alcohol the two isomers can be separated, as the fusible anilide crystallizes in thin white needles, while the infusible variety crystallizes in short thick prisms. Phosphorus oxychloride and phosphorus pentoxide removed one molecule of water from both compounds forming the dianil,  $C_6H_4\left\langle\begin{matrix}C=NC_6H_5\\SO_2\end{matrix}\right\rangle NC_6H_5$, which had already been obtained by Jesurin (*Ber. d. chem. Ges.*, 26, 2292) by the action of aniline on orthocyanbenzenesulphonchloride. The compound crystallizes in yellow monoclinic prisms, is changed by boiling acetic acid or alcoholic potash into the infusible anilide, and is decomposed into the anil $C_6H_4SO_2.CO.NC_6H_5$ and aniline by boiling hydrochloric acid. The infusible anilide reacts with benzoyl chloride, forming the anil and benzanilide. Since the above facts show that the two aniline residues are intact in the infusible anilide, and since the latter compound is obtained only from the unsymmetrical chloride, it follows that the structure of the anilide is  $C_6H_4\left\langle\begin{matrix}C=(NHC_6H_5)_2\\SO_2\end{matrix}\right\rangle O$. (VI.) The mixed chlorides of orthosulphobenzoic acid were dissolved in ether and shaken with ice-cold dilute ammonia. From the water solution the ammonium salt of orthocyanbenzenesulphonic acid crystallized in botryoidal masses of transparent needles. The sodium, potassium, and barium salts were prepared, and from the latter orthobenzaminesulphonic acid,  $C_6H_4<\begin{matrix}CONH_2\\SO_2OH\end{matrix}$ + H_2O, was obtained in an endeavor to get the free cyan acid, $C_6H_4.CN.SO_2OH$. The ammonium salt of the former acid was obtained by boiling the ammonium salt of the latter with dilute hydrochloric acid for eight hours. The potassium, sodium, and barium salts of benzaminesulphonic acid were formed by boiling the ammonium salt of cyanbenzenesulphonic acid with an excess of the respective hydroxides.

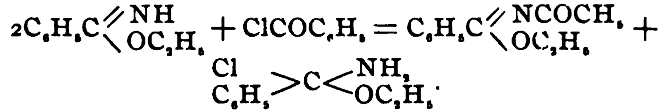
On Parabromdimetanitrotoluol and Some of Its Derivatives. By C. Loring Jackson and Martin H. Ittner. *Am. Chem. J.*, **19**, 1–37.—The work described was undertaken in order to find out whether a bromine atom in the ortho position between two nitro groups, but not exposed to the loosening action of a third negative group in the para position, could be removed easily, and be replaced by a hydrogen atom under the influence of sodium malonic ester, as has been frequently observed by Jackson and his pupils in the study of more highly substituted aromatic compounds. The compound selected for investigation, parabromdimetanitrotoluene, proved to be not very reactive ; but this was probably due to the influence of the methyl group. It was prepared from dinitrotoluidine, melting at 166°, and was converted by warm aniline into anilidodinitrotoluene (m. pt. 169°), which gave a nitroso derivative, which melts at 123°. Although sodium malonic ester did not act upon bromdinitrotoluene under a variety of conditions, sodium ethylate gave striking color reactions, which are to be described in another paper. The bromine was not replaced, as no dinitrotoluene was found. With ammonia, bromdinitrotoluene gives dinitrotoluidine, and with sodium hydroxide, dinitrocresol. Parabromdimetanitrobenzoic acid was made by oxidizing the corresponding toluene. It melts at 181°, and is more reactive than parabromdinitrotoluene, since the bromine atom is affected by the carboxyl group in the para position. Sodium hydroxide in the cold converts it into oxydinitrobenzoic acid (m. pt. 245°–246°). Bromdinitrobenzoic acid gives, with ammonium hydroxide, chrysanisic acid ; with aniline, anilidodinitrobenzoic acid ; and with sodium, malonic ester, at ordinary temperatures, dinitrocarboxylphenylmalonic ester, $C_6H_2CH(COOC_2H_5)_2(NO_2)_2COOH$ (m. pt. 176°.) A number of the salts and the ethyl esters of the acids were prepared. An attempt was made to build up very complex molecules from some of the substances described, in order to study the effect of complexity of structure on physical properties. The resulting compounds soon ceased to be crystalline, and the work was therefore abandoned. By the action of pyridine on bromdinitrobenzoic acid two compounds were obtained: a white body, probably a simple salt of the acid ; and a very unstable yellow compound whose reactions pointed to the structure, $C_6H_5NBrC_6H_2(NO_2)COOHNC_6H_5$. Some preliminary work on the action of hydrochloric acid on bromdinitrobenzoic acid showed that the products were dinitrophenol (OH, 1, $(NO_2)_2$2,6) and oxydinitrobenzoic acid.

Aluminum Ethylate. By H. W. Hillyer and O. E. Crooker. *Am. Chem. J.*, **19**, 37–44.—In a previous paper (*Am. Chem. J.*, **18**, 621 ; *this Rev.*, **2**, 80), Hillyer has shown that aluminum reacts with alcohol in which mercuric or stannic chloride is dissolved, liberating hydrogen and forming a gelatinous mass. During the reaction the metallic chlorides are reduced. The reaction has been studied further ; and the authors are of the opinion that it is due to the joint influence of the aluminum-mercury couple and the aluminum chloride formed in the reduction of the mercuric chloride. The product of the reaction when distilled under a pressure of 23 mm. boiled at 235°–245°, and solidified to a gummy mass which melted at 135°. A mixture of one cc. of stannic chloride, 5 grams of chipped aluminum, and 50 cc. of absolute alcohol gives the best results. The authors consider that the chlorine found in the distillate, even after a number of distillations, shows the presence of aluminum chloride. The compound was analyzed for chlorine and aluminum, and, deducting the amount of the latter equivalent to the chlorine, the analyses give results closely approximating those required for aluminum ethylate, $Al(OC_2H_5)_3$. The properties of the compound agree with those of the ethylate prepared by Gladstone and Tribe (*J. Chem. Soc.*, 39, 1) by the action of aluminum and iodine on alcohol.

Paraisobutylphenoxyacetic Acid. By W. P. Bradley and F. Kniffen. *Am. Chem. J.*, 19, 70–76. — Paraisobutylphenoxyacetic acid was prepared by heating paraisobutylphenol and chloracetic acid dissolved in sodium hydroxide. The mixture was neutralized with sulphuric acid, treated with an excess of sodium carbonate, and extracted with ether to remove any excess of phenol. The resulting liquid was then evaporated to a small bulk, acidified, and the acid extracted with ether. The compound is a cream white solid, melts at 86°.5, and crystallizes from ligroïn in radial crystals. The barium and magnesium salts crystallize well. The amide, prepared from the methyl ester, crystallizes from ligroïn in white plates, which melt at 134°. The anilide, metanitranilide, ortho- and paratoluides, and hydrazide are described. A tetranitro derivative of the anilide was formed by the action of fuming nitric acid. The fact that the four nitro groups are divided equally between the two benzene rings was proved by the action of potassium hydroxide, which decomposed the compound into the ortho- and paradinitraniline.

Formation of Diacetylenyl (Butadiine) from Copper Acetylene. By A. A. Noyes and C. W. Tucker. *Am. Chem. J.*, 19, 123–129.—The object of the investigation was to establish the constitution and to explain the formation of the crystalline compound of the formula $C_4H_2Br_6$, obtained by Sebanejeff, (*Ber. d. Chem. Ges.*, 22*c*, 249) by passing acetylene, from copper acetylene, into boiling bromine. The attempts to prepare the body by the action, upon boiling bromine, of acetylene generated from calcium carbide, were unsuccessful. The gas obtained by the action of hydrochloric acid on the copper compound prepared from acetylene generated from calcium carbide was passed into boiling bromine. A 4 per cent. yield of crystals, identical in properties with those of Sebanejeff, was obtained. Substitution of potassium cyanide for hydrochloric acid, and varying the condition of combination of the gas with bromine did not affect the result. As the addition of strips of metallic copper to the copper acetylene during decomposition prevented the formation of the compound, it seemed probable that its formation was due to the oxidizing action of the cupric chloride formed by the contact of the decomposing mixture with the air. Copper acetylene was decomposed in the presence of cupric chloride, and the yield was increased to 9 per cent. When molecular quantities of copper acetylene and cupric chloride were heated for 3 hours, the latter was entirely reduced. Analyses and molecular weight determinations of the bromide showed that its formula is $C_4H_2Br_6$. It melts at 183°.5 (corr.), crystallizes in colorless orthorhombic plates, evolves bromine when heated above its melting-point, and furnishes a distillate, which partially recombines with the bromine vapors, when heated at 220° under a pressure of 40 mm. That the body is not a derivative of the hydrocarbon $(CH)_4$ is shown by the facts, that it is obtained from the oxidation-products of acetylene or its copper compound, and that the gas evolved from copper acetylene is completely absorbed by ammoniacal cuprous chloride, thus showing it to consist only of triple-bonded compounds. The only explanation is that the bromide is formed by the union with bromine of the hydrocarbon C_4H_2, diacetylenyl or butadiine, obtained from its copper compound, which is formed according to the reaction $2C_2Cu_2 + CuCl_2 = C_4Cu_2 + 2Cu_2Cl_2$. That the hydrocarbon combines with only six atoms of bromine is explained by the principle that unsaturated compounds containing a large proportion of halogen often do not become completely saturated. From the gases evolved from copper acetylene a liquid was condensed, which boiled at 40° to 50° and gave with bromine diacetylenyl hexabromide. The crude product was not the pure hydrocarbon, for it contained a large proportion of chlorine.

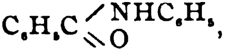
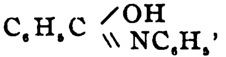
On the Action of Acid Chlorides on the Imido Esters and Isoanilides, and on the Structure of the Silver Salts of the Anilides. BY H. L. WHEELER AND P. T. WALDEN. *Am. Chem. J.*, 19, 129–139.—As the silver salts of the anilides react with acid chlorides as if the metal were joined to nitrogen, and with alkyl halides as if the metal were joined to oxygen, it follows that both reactions cannot be direct double decompositions. It seems probable that addition first takes place, and that this is followed by separation of silver halide. In order to show which of the two possible structures of the silver salts of the anilides $RC\genfrac{}{}{0pt}{}{\diagup NR'Ag}{\diagdown O}$ or $RC\genfrac{}{}{0pt}{}{\diagup\!\!\diagup NR'}{\diagdown OAg}$ is correct, the action of acid chlorides was studied on the isoanilides and imido esters, which, it is probable, contain the grouping $RC\genfrac{}{}{0pt}{}{\diagup\!\!\diagup NR'}{\diagdown OR''}$. With the isoanilides an unstable addition-product is first formed, which breaks down with evolution of alkyl chloride and formation of a mixed diacid anilide. As the reaction takes place readily and is analogous to that between the acid chlorides and the silver salts of the anilides, it follows that the metal is joined to oxygen in the latter compounds. This is in accord with the conclusion of Comstock and Kleeburg (*Am. Chem. J.*, **12**, 495). Acid chlorides react with imido esters forming an addition-product from which hydrochloric acid is eliminated. The acid reacts with the excess of the imido ester:



$$2C_6H_5C\genfrac{}{}{0pt}{}{\diagup\!\!\diagup NH}{\diagdown OC_2H_5} + ClCOC_6H_5 = C_6H_5C\genfrac{}{}{0pt}{}{\diagup\!\!\diagup NCOC_6H_5}{\diagdown OC_2H_5} + \genfrac{}{}{0pt}{}{Cl}{C_6H_5}{>}C{<}\genfrac{}{}{0pt}{}{NH_2}{OC_2H_5}.$$

When the acyl imido esters are treated with acids they react with water to form diacid amides and alcohol. The decomposition is analogous to the action of the silver salts of the amides and anilides with acids, and is evidence, therefore, that the diacid amides have both acid groups joined to nitrogen. The action of bromine and iodine on the imido esters is similar to that of the acid chlorides. The new compounds described are formylbenzenesulphonanilide, $C_6H_5N(CHO)SO_2C_6H_5$, benzoylimidoethylbenzoate, $C_6H_5C(NCOC_6H_5)OC_2H_5$, acetylimidomethylbenzoate, bromimidomethylbenzoate, $C_6H_5C(NBr)OCH_3$, and iodimidomethylbenzoate.

On the Effect of Light on the Displacement of Bromine and Iodine from Organic Bromides and Iodides. By J. H. KASTLE AND W. A. BEATTY. *Am. Chem. J.*, **19**, 139–149.—The authors have found that chlorine liberated from dichlorsulphonamide by the action of light can displace bromine and iodine from their most stable compounds, and that the bromine of dibromsulphonamide, when liberated, can displace iodine from the benzene ring. In the dark there is no liberation of chlorine from the amide and, consequently, no displacement of bromine or iodine from organic halides, except from unstable compounds like iodoform, where a direct reaction takes place. Chlorine water caused a similar decomposition. Experiments showed that up to 50° the reaction is more dependent upon light than heat. At 14°–18° a mixture of dibrombenzene and chlorine water, after six hours exposure to direct sunlight, gave a good test for bromine, while a similar mixture, heated for five hours in the dark at 50°, suffered no change. Above 50° the reaction takes place in the dark. When *p*-dibrombenzene and chlorine water were exposed to the sunlight for a number of days, a large proportion of the bromine was liberated and a substance, probably a mixture of *p*-chlorbenzene and *p*-brombenzene or *p*-chlorbrombenzene, was formed.

The Constitution of Benzanilide. By N. Knight. *Am. Chem. J.*, **19**, 152–154.—If the formula of benzanilide is  $C_6H_5C\begin{array}{l}\diagup NHC_6H_5\\ \diagdown\!\diagdown O\end{array}$, the same product should result when benzenesulphanilide is treated with benzoyl chloride, or when benzanilide is treated with benzenesulphonchloride. If the formula is  $C_6H_5C\begin{array}{l}\diagup OH\\ \diagdown\!\diagdown NC_6H_5\end{array}$, the reaction-product should be different. The above reactions were studied, but, as in both cases there was a complete breaking down, and a number of substances were formed, no conclusion as to the structure could be drawn. The chief products of the reaction were dibenzoyl anilide and the aniline salt of benzenesulphonic acid.

On the Decomposition of Diazo Compounds. IX. On the Reactions of Ethyl and Methyl Alcohols with Paradiazometatoluenesulphonic Acid in the Presence of Various Substances. By John J. Griffin. *Am. Chem. J.*, 19, 163–183.—The work described in this communication, the ninth from the laboratory of the Johns Hopkins University on the subject of diazo compounds, is in accord with the results already published. It has been found that, when paradiazometatoluenesulphonic acid is decomposed below 45° in methyl or ethyl alcohol in the presence of sodium methylate, sodium carbonate, sodium hydroxide, or zinc dust, only the hydrogen reaction takes place. The yield of the resulting acid was determined by converting it into the amide. The best yield (50 grams amide from 100 grams diazo compound) was obtained by effecting the decomposition in ethyl alcohol in presence of zinc dust, treating the resulting mass with phosphorus trichloride and then with ammonia. It is remarkable that the product obtained by decomposing the diazo compound in presence of sodium carbonate did not react with phosphorus trichloride, but was changed into the sulphonchloride by the pentachloride. The diazo compound was not decomposed when treated at 45° with alcohol and calcium carbonate. When decomposition takes place in alcohol saturated with ammonia, the ammonium salt of paratoluidinemetasulphonic acid is formed. Metatoluenesulphonamide melts at 108°, and crystallizes from concentrated solutions in brilliant hexagonal scales and from dilute solutions in large fern-like growths. The amide was oxidized to metasulphaminebenzoic acid, from which the barium and silver salts were made.

On Metatoluenesulphonic Acid. BY JOHN J. GRIFFIN. *Am. Chem. J.*, **19**, 183–198.—From a study of the literature of metatoluenesulphonic acid, a review of which is given by the author, it is evident that the properties of the acid and its salts are not definitely known. A large amount of pure metatoluenesulphonamide, which was obtained in the work described in the previous review, was converted into the acid, from which the barium, lead, calcium, sodium, potassium, silver, magnesium, manganese, zinc, and copper salts were prepared. These are described in detail. From the study of the acid and its salts it is evident that the compounds described by Müller (*Ann. Chem.*, **169**, 47) and by others who have employed analogous methods of preparation were impure products.

The Preparation of Diethyl Malonic Ester. BY W. A. NOYES. *J. Am. Chem. Soc.*, **18**, 1105.—The time required for the preparation of malonic ester is much reduced by heating the reacting substance with sulphuric acid for an hour instead of treating with dry hydrochloric acid gas. The yield of the ester is equal to the weight of the chloracetic acid taken. This is 10 to 15 per cent. better than by the old method.

Color Reactions of Nitric and Chloric Acids with Certain Aromatic Bodies. BY E. C. WOODRUFF. *J. Am. Chem. Soc.*, **19**, 156–169.—The color reactions of nitric and chloric acids with a large number of aromatic compounds were studied, in order to find some new practical tests for the two acids both separately and in mixtures. The procedure was to treat the test solution, generally as a mixture of 10 grams of aromatic body and 100 cc. sulphuric acid, with a drop of a nitrate or a chlorate or a mixture of the two. After standing a short time, potassium hydroxide or ammonium hydroxide is added and the solution is diluted. The color is noted at three stages, before and after neutralization, and after dilution. The results with twenty hydroxyl and amido derivatives are tabulated. Phenol serves to distinguish between the two acids, as nitrates give a strong picrate-colored solution, while chlorates give a brownish-yellow color. Nitrates can be detected in the presence of chlorates, bromates, and iodates, as they give a strong blood-red color with a mixture of dimethylaniline, paratoluidine, and sulphuric acid. Reference must be made to the original article for a number of other interesting observations.

GEOLOGICAL AND MINERALOGICAL CHEMISTRY.

W. O. CROSBY, REVIEWER.

Italian Petrological Sketches, II. The Viterbo Region. By HENRY S. WASHINGTON. *J. Geol.*, 4, 826–849.—Lavas of two distinct types, obtained from the Viterbo region, which lies a few kilometers southeast of the volcanic district of Lake Bolsena, are described, the trachytic lavas under the names vulsinite, ciminite and peperino, and leucitic lavas, under the name of leucite-trachyte. One original analysis of ciminite is given, and three earlier ones are quoted for comparison. These show that while as regards the silica, alumina, lime or iron the rock approaches the andesites rather than the trachytes, yet that the potash is largely in excess of the soda, and that the rock is far richer in total alkalies than is the case with the true andesites. On the other hand, the magnesia is also abnormally high for a trachyte. Analyses are also given of the vulsinite, leucite-trachyte, and a phonolite, which occurs very sparingly, as dikes and enclosed masses.

Italian Petrological Sketches, III. The Bracciano, Cerveteri and Tolfa Regions. By HENRY S. WASHINGTON. *J. Geol.*, 5, 34–49.—As in the Viterbo region, the rocks embrace both non-leucitic and leucitic types; but these are regarded as specifically distinct from the Viterbo rocks, and are described, the former under the name toscanite, and the latter under the names leucitite, leucite-tephrite, and leucite-phonolite. Original analyses of all these are given in tabular form; and the distinctive chemical features are briefly indicated.

The Principles of Rock Weathering. By GEORGE P. MERRILL. *J. Geol.*, 4, 704–724; 850–871.—This is an able and comprehensive summary of our knowledge of the subject, and must prove of great value to students. Both the chemical and physical aspects of the problem are discussed; and no more important results are presented than those derived from the author's earlier contribution to the literature of rock decay.

The Anorthosites of the Rainy Lake Region. By A. P. COLEMAN. *J. Geol.*, 4, 907–911.—In the vicinity of Rainy and Bad Vermilion Lakes very basic and very acid igneous rocks—anorthosites and quartzose granites—are found associated. One analysis of each is given, and an analysis of anorthosite from Quebec is quoted for comparison. It appears that the anorthosite from the Rainy Lake region is one of the most basic of the massive rocks, having about eight per cent. less silica than the typical anorthosites of Eastern Canada. A suggestion for a binomial nomenclature of these rocks is followed by a brief discussion of their age and petrologic relations.

The "Augen"-Gneiss Area, Pegmatite Veins and Diorite Dikes at Bedford, N. Y. BY LEA McL. LUQUER AND HEINRICH RIES. *Am. Geol.*, **18**, 239–261.—Two analyses of the feldspar in the pegmalite veins show that it is a normal orthoclase.

A New and Important Source of Phosphate Rock in Tennessee. BY JAMES M. SAFFORD. *Am. Geol.*, **18**, 261–264.—The Trenton limestone of the region about Nashville, and especially the member of it known as the Capitol limestone, is normally more or less phosphatic, the richer parts showing upon analysis from 15 to 25 per cent. of phosphate. The true phosphate rock is a residuum after the leaching by meteoric waters of the phosphatic limestone. It is found immediately beneath the soil in layers from three to eight feet thick, and is in every respect of a distinctly residuary character. An analysis by J. M. McCandless, of Atlanta, gave: Calcium phosphate (bone phosphate), 77.54; iron and alumina, 1.50; calcium carbonate, 6.83. Other analyses made in Nashville show the calcium phosphate to range from 60 to 81 per cent.

The Arlington Iron. Minnesota No. 2. BY N. H. WINCHELL. *Am. Geol.*, **18**, 267–271.—This iron, weighing 19¾ pounds, was found two and a half miles northeast of Arlington, Minn., in March, 1894. It proved on examination to be a typical metallic meteorite, and an analysis by F. F. Sharpless, gave the following results: Fe, 90.781; Ni, 8.605; Co, 1.023; P, 0.045; total, 100.454. It yielded no sulphur, silicon, or manganese, and only traces of chromium, copper and combined carbon.

Missourite, a New Leucite Rock from the Highwood Mountains of Montana. BY WALTER H. WEED AND LOUIS V. PIRSSON. *Am. J. Sci.* **152**, 315–323.—The Highwood Mountains form an isolated group consisting of extinct, greatly eroded volcanoes. Forming the core of one of these denuded volcanoes is a granular rock of a new type and of exceptionally interesting petrologic character to which the authors have given the name Missourite. The microscope shows the following minerals: apatite, iron ore, olivine, augite, biotite, leucite, and some zeolitic products. As the presence of leucite in a granular plutonic rock was before unknown, particular pains were taken to place its identification beyond doubt. It was isolated by means of a heavy solution, and found to have the specific gravity, optical characters, and composition ($KAl(SiO_3)_2$) of leucite. With one exception, this is the first analysis of a leucite from other than an Italian locality. The zeolitic products were similarly isolated and analyzed, and proved to be analcite and a natrolite in which potash and lime have replaced soda. A mass analysis of the rock by E. B. Hurlburt is also given. This brings out strongly the leading characteristics of the rock, its very high lime, iron, and magnesia, which have compelled the formation of large quantities of pyroxene and olivine; the predominance of potash over soda, which with the low silica have conditioned the formation of the leucite, and which explains why no feldspars have formed. The mineralogical composition is believed to be: iron ore, 5; augite, 50; olivine, 15; biotite, 6; leucite, 16; analcite, 4; and zeolites, 4 per cent. Analyses of absarokite, shonkinite, and a leucite basalt are quoted for comparison; and it is shown that this rock fills a place which has hitherto been vacant in all systems of rock classification. It is the massive, granular, plutonic representative of the leucite basalts and bears the same relation to them that gabbro bears to the ordinary plagioclase basalts or granite to rhyolite.

Chemical Composition of Hawaiian Soils and of the Rocks from Which They Have Been Derived. BY A. B. LYONS. *Am. J. Sci.*, 152, 421–429.—The author states that the relation in chemical composition of soils to the rocks from which they are definitely derived, can be studied most easily and profitably in a volcanic country, where disintegration of the rock is rapid and is attended by great chemical changes. The chemical composition of these volcanic soils is peculiarly interesting and full of surprises to one unaccustomed to their vagaries. Ten original analyses of the soils are given, classified as follows: New soils from lapilli (recent fragmental lava); new soils from lava only partially disintegrated; old soils from thoroughly disintegrated ancient lava. The new soils are of a sandy character, containing but little clay; and yet the mineral constituents requisite for plant food—potash and phosphoric acid—are present in extraordinary abundance. Two of the lapilli soils are almost incredibly rich in phosphate, containing respectively 2.92 and 6.47 per cent. P_2O_5. The old soils are clayey, of a deep red color, and relatively poor in phosphate, though comparing very favorably in potash with the new soils. The lavas are highly basic rocks, the more recent forms running as low in silica as 35.86 per cent., the average of the nine analyses given being 47.86 per cent. The ultra-basic recent lavas, especially, are rapidly decomposed by acids with separation of gelatinous silica and evolution of hydrogen sulphide. The variations are 0.17 to 2.75 per cent. K_2O, and 0.26 to 1.25 per cent. P_2O_5; the averages are 1.07 per cent. K_2O and 0.65 per cent. P_2O_5. A third table of analyses gives the composition of lavas altered by exposure to the weather. There has been a notable loss of silica, the average being reduced to 21.32 per cent., with a minimum of 4.54 per cent.; while the alkalies and alkaline earths have almost wholly disappeared. A fourth table compares the averages of all the analyses of sound lava, rotten lava, and soil.

Some Queries on Rock Differentiation. BY GEO. F. BECKER. *Am. J. Sci.*, 153, 21–40.—This paper is an able and timely criticism of the general theory of magmatic differentiation, and especially of the attractive phase of this theory that was first distinctly formulated by Iddings, which regards molten magmas as complex solutions, and hence, in accordance with Soret's principle, subject to differentiation by molecular diffusion when the temperature is not uniform. The author does not deny that diffusion plays some part in lithogenesis, recognizing its operation in the formation of phenocrysts and in the "diffusion aureoles" surrounding eroded crystals. But his criticism is aimed at the view that masses of rock hundreds of meters in thickness could be thus separated, even if the time allowed for completion of the process were equal to an entire geological period. The results of experiments are cited to show that even under the most favorable conditions molecular diffusion is an exceedingly slow process. For example, it is calculated that at the expiration of a million years water would be just sensibly discolored by copper sulphate at a distance of 350 meters from the point of contact with a saturated solution and that semi-saturation would have reached only a distance of some 84 meters. It is assumed that for a typical lava these periods would be at least 50 times greater. Probably a mass of lava of a volume of one cubic kilometer would not have had time to segregate into distinctly different rocks by molecular flow if it had been kept melted since the close of the Archaean, even if the temperature of the top could have been kept sensibly above the temperature of the bottom, a highly improbable condition. If the bottom were more highly heated than the top, convection currents would effectually prevent any segregation in accordance with Soret's principle. Convection is regarded as inevitable in every instance and as constantly and completely neutralizing any possible effect of diffusion. The author next examines the theory that rock differentiation is due to the separation of the magmas during cooling into two or more immiscible fluids, citing the experiments of Alexejew, Pfeiffer, Sorby, Braun, and others. The conclusion reached is that while such a breaking up of magmas probably occurs under favorable conditions, no known causes are adequate to the segregation of the immiscible fluids. The author thus virtually abandons the whole theory of rock differentiation, and for an explanation of the great diversity of igneous rocks falls back upon the view that the differences between well-defined rock types are due to original and persistent heterogeneity in the composition of the globe.

On Igneous Rocks from Smyrna and Pergamon. BY HENRY S. WASHINGTON. *Am. J. Sci.*, 153, 41–50.—This paper contains detailed descriptions and chemical analyses of two rock types, augite-andesite and biotite-dacite.

Notes on the Artesian Well Sunk at Key West, Florida, in 1895. BY EDWARD OTIS HOVEY. *Bull. Museum Comp. Zool.*, **28**, No. 3, 65–91.—In 1895 an artesian well was sunk at Key West, Florida, to the depth of 2,000 feet. Samples of the borings were taken every 25 feet from the surface to the bottom; and this paper embodies the results of a microscopic and chemical examination of these. The material is throughout an almost perfectly pure lime-rock, loosely compacted in the main, and varying from sandy to oölitic in texture, indicating a shallow water origin for a large part of it. Nearly all the samples contain a small proportion of quartz in the form of a fine grained angular sand. Thirteen samples from as many different depths were analyzed. These are seen to be all slightly magnesian, the MgO varying from 0.29 to 6.70 per cent. The silica (chiefly quartz) varies from 0.03 to 5.10 per cent. All the samples contain some phosphoric acid, but this together with the iron and alumina amounted at the most to only 0.40 per cent.

The Genesis of the Talc Deposits of St. Lawrence County, N.Y. BY C. H. SMYTH, JR. *School Mines Quart.*, 17, 333-341.—The crystalline limestones of St. Lawrence County are frequently tremolitic, and pass into tremolite and enstatite schist. The talc is clearly due to the alteration of these anhydrous silicates. Its secondary origin is proved in most cases by its pseudomorphic character, retaining perfectly the form and structure of the original minerals, and showing every gradation in the process of alteration. The so-called veins of talc are, therefore, simply altered beds of tremolite and enstatite schist. The chemistry of the conversion of enstatite and tremolite into talc is expressed by the following equations:

$4MgSiO_3$(enstatite) $+ H_2O + CO_2 = H_2Mg_3Si_4O_{12}$(talc), $+ MgCO_3$;

$CaMg_3Si_4O_{12}$, (tremolite) $+ H_2O + CO_2 = H_2Mg_3Si_4O_{12}$(talc) $+ CaCO_3$.

The substitution of hydrogen for calcium in the latter reaction is quite in harmony with the generally accepted view that talc is an acid metasilicate, $Mg_3H_2(SiO_3)_4$. The essential agents of alteration are evidently provided by circulating water holding CO_2 in solution, and many occurrences of talc pseudomorphs show that the change may occur under ordinary conditions of pressure and temperature. Considering its origin, the composition of the talc is surprisingly close to that demanded by theory, as is shown by the analyses which are given.

[CONTRIBUTION FROM THE MASSACHUSETTS INSTITUTE OF TECHNOLOGY.]

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ARTHUR A. NOYES, Editor; HENRY P. TALBOT, Associate Editor.

REVIEWERS: Analytical Chemistry, H. P. Talbot and W. H. Walker; Biological Chemistry, W. R. Whitney; Carbohydrates, G. W. Rolfe; General Chemistry, A. A. Noyes; Geological and Mineralogical Chemistry, W. O. Crosby; Inorganic Chemistry, Henry Fay; Metallurgical Chemistry and Assaying, H. O. Hofman; Organic Chemistry, J. F. Norris; Physical Chemistry, H. M. Goodwin; Sanitary Chemistry, E. H. Richards; Technical Chemistry, A. H. Gill and F. H. Thorp.

GEOLOGICAL AND MINERALOGICAL CHEMISTRY.

W. O. CROSBY, REVEIWER.

Notes on the Ecloite of the Bavarian Fichtelgebirge. BY DAVID HALE NEWLAND. *Trans. N. Y. Acad. Sci.*, 16, 24–29. —This fragmentary petrographic sketch is accompanied by analyses of the rock and of certain of its component minerals. The discussion is brief and develops no points of general interest.

The Geology of Point Sal. BY HAROLD W. FAIRBANKS. *Bull. Dept. Geol. Univ. Cal.*, 2, 1–91.— This is a detailed study of a limited area of Cretaceous and Tertiary strata with associated volcanic rocks in the north-western part of Santa Barbara County, California. The petrographic descriptions are freely supplemented by chemical analyses of the various rocks, both sedimentary and igneous. The bituminous shales of the Miocene series embrace a white porcelain-like variety which gave: SiO_2, 86.92; Al_2O_3, 4.27; CaO, 1.60; $K_2O + Na_2O$, 2.48; loss on ignition, 5.13; total, 100.40. This agrees closely with an analysis by Lawson and Posada of the bituminous shale at Monterey. Two analyses of flint are also quoted for comparison. The author rejects the view that this rock is an acid soda rhyolite, and regards it as essentially of organic origin, a consolidated tripolite. The volcanic ash interstratified with the Miocene strata is proved by analysis to be an acid rhyolite, containing 74.841 per cent. of SiO_2. Augite-teschenite, previously described by the author as analcite dialase, forms large dikes in the gypsiferous Miocene strata. This rock is of especial interest on account of the abundant occurrence of analcite in it. The author is confident that the analcite is secondary after some soda-rich original silicate, like nepheline. Analyses are given for the rock as a whole and for its chief constituents—augite, feldspar, and analcite. From the analyses the proportions of the component minerals are computed and found to agree very closely with the results of a mechanical separation by means of a heavy solution and magnet. An elaborate discussion of the composition and a comparison with European teschenites bring the author to the conclusion already stated that the analcite was derived from nepheline, although not a recognizable trace of nepheline now remains. Analyses are also given of gabbro, andesite, and spheroidal basalt. The paper concludes with a discussion of magmatic variation, the author's view being that the rocks in question have come up from a deep basic zone in the earth's crust—a wide-spread body of basic magma of nearly homogeneous composition. This primitive basic magma has experienced both primary and secondary differentiation in the chimneys subsequent to its eruption, through a variety of causes, Rosenbusch's theory of segregation in obedience to chemical affinity being regarded as the most generally applicable.

Notes on the Occurrence of a Rich Silver and Gold Mineral Containing Tellurium, in the Griffith Lode, near Georgetown, Clear Creek County, Colorado. By RICHARD PEARCE. *Proc. Col. Sci. Soc.*, Oct. 5, 1896.—The mineral occurs only in small quantities, associated with pyrite, galenite and chalcopyrite, in a feldspathic matrix containing small quantities of magnesite. The color is dark gray with a bright metallic luster; hardness about 3. An analysis by F. C. Knight of approximately pure material gave: Ag, 50.65; Te, 18.80; Pb, 9.34; Cu, 4.65; Fe, 4.00; Bi, 1.16; S, 8.06; $MgCO_3$, 1.95; alloy of Au and Ag, 0.48; insoluble residue, 1.07; total, 100.16. The author refers the gold wholly to the alloy, which he found to be 725 fine, and regards the mineral as an intimate mixture made up as follows: Hessite, 51.22; argentite, 20.93; Cu_2S, 5.82; FeS, 6.28; PbS, 10.78; Bi_2S_3, 1.45; Au and Ag alloy, 0.48; $MgCO_3$, 1.95; insoluble residue, 1.07; total, 99.95. The Cu_2S and FeS are supposed to be combined as chalcopyrite; and it is noted that the relation between the hessite and argentite corresponds closely to the formula $2Ag_2Te + Ag_2S$.

Notes on the Occurrence of Tellurium in an Oxidized Form in Montana. By RICHARD PEARCE. *Proc. Col. Sci. Soc.*, November 2, 1896.—No complete analyses are given; but the author concludes that below the zone of oxidation sylvanite occurs with rich silver minerals.

Sepiolite. By E. HELMHACKER. *Eng. Min. J.*, **62**, 80–82. This paper discusses the mode of occurrence of sepiolite in Asia Minor and other regions, its derivation from serpentine, and the varieties based upon differences of composition.

Wolfram Ore. By E. Helmhacker. *Eng. Min. J.*, **62**, 153–154.—The author describes the occurrence of the mineral wolfram with the tin ores of the Erzgebirge and other districts, discusses its influence in the manufacture of steel, gives analyses of the three grades obtained by concentration, and discusses the method of analysis.

The Geology of the Fox Islands, Maine. By George Otis Smith. *Dissertation at Johns Hopkins Univ.*, 1–76.—This thorough and every way admirable petrologic study embodies original analyses of several of the igneous rocks, including an andesite and an aporhyolite.

General Geology of the Cripple Creek District, Colorado. By Whitman Cross. *Ann. Rep. U. S. Geol. Survey*, **16**, (*part 2*), 13–109.—The rocks of the Cripple Creek District include the pre-Cambrian granites, gneisses and schists, and the tertiary volcanics. The most characteristic product of the Cripple Creek volcano is the phonolite. This is chiefly composed of alkali feldspar and nepheline, with sodalite and nosean, and a pyroxene rich in alkali and iron. Four closely accordant analyses by Dr. Hillebrand are given, and three others are quoted for comparison. The proportions of SO_3 and Cl prove sodalite to be more abundant than nosean; the aegirine augite varies with the proportion of lime; zircon crystals are exceedingly rare, and the zirconia disclosed by the analysis is attributed to the rare mineral levenite. From 25 to 40 per cent. of the rock is soluble in HCl, indicating a large amount of nepheline. A trachytic phonolite is next described, with a single analysis, which shows that it differs chiefly from the typical phonolites in the increased percentage of lime. The solubility test indicates a much smaller proportion of nepheline. A nepheline syenite occurring at one point is regarded as a granular representative of the phonolites. The analysis shows that although more basic it is very closely related to the phonolite magmas. The other volcanic rocks described are augite-syenite-porphyry, andesite, plagioclase-basalt and nepheline-basalt, tuff and breccia and rhyolite. These lithologic descriptions are introductory to a detailed structural study of the Cripple Creek volcano, chiefly as exposed in the numerous mines.

Mining Geology of the Cripple Creek District, Colorado. By R. A. F. Penrose, Jr. *Ann. Rep. U. S. Geol. Survey*, **16**, (*part 2*), 111–209.—No part of the work of the United States Geological Survey deserves higher commendation than its splendid series of timely monographs on the economic geology of the country. The unique character of the Cripple Creek district makes the present contribution especially noteworthy and valuable. The brief introductory and historical sections are followed by a chapter on the ores. The gold occurs chiefly in combination with tellurium; but near the surface the tellurium occurs chiefly in oxidized forms, and the gold is mainly free. That this free gold has come chiefly from the oxidation of the telluride is proved by the angular shape of the pieces of gold, their pseudomorphic striation, their porosity and the presence of oxidized tellurium materials in the rusty coating of the gold. Hillebrand has proved the gold telluride to be calaverite, the proportion of silver being much too low for sylvanite. Auriferous pyrite also occurs, but is not deemed an important source of gold. Among the oxidation products of the pyritic ores is a mineral which Hillebrand has shown to be a hydrated ferric silicate related to chloropal. The analysis gave: SiO_2, 41.80; Fe_2O_3, 37.0; H_2O, 19.90; CaO, 1.10; total, 100.00. The widely distributed manganese oxide is supposed to be derived chiefly from the carbonate or silicate. In a few mines silver occurs in notable amounts, as shown by several analyses and assays; but these do not indicate clearly its mineralogical relations. Lead occurs only very sparingly, as galena or its oxidation products. Zinc also occurs sparingly as the sulphide, sphalerite, and a single analysis is given. Copper is one of the rarest metals in the district; but one occurrence of tetrahedrite containing 11.19 per cent. of silver is noted. Among the gangue minerals a purple fluorite is most characteristic. Besides quartz, there are hydrous forms of silica, including hyalite. The so-called jasper is proved by analysis to be a highly ferruginous opal. Along the line of the veins, especially, the feldspathic constituents of the rocks are extensively kaolinized, and three analyses are given to show that the composition of the kaolin is essentially the same whether derived from the granite, phonolite, or andesite. Calcite and gypsum are rather rare secondary minerals. The next chapters are devoted to the mode of occurrence of the ores, and the source and mode of deposition of the ores. The ores have been derived from the country rocks, both granitic and volcanic, at a considerable depth, and have been deposited largely through fumarole action, in fissures or fissured zones, with extensive replacement of the rocks.

Economic Geology of the Mercur Mining District, Utah. By J. Edward Spurr. *Ann. Rep. U. S. Geol. Survey*, 16, (*part 2*), 343-455.—This latest of the economic monographs of the Survey describes the most recently developed of all the great mining camps of the West. Like Cripple Creek, this is now distinctively a gold-mining camp, and one of a sufficiently unique character, for the gold ores remained undiscovered for many years within 100 feet of the now long abandoned silver mines.

There are two ore-bearing horizons about 100 feet apart near the middle of a great series of limestone strata, each occurring as an impregnation or replacement of limestone along the lower contact of an intrusive sheet of porphyry. The principal vein materials of the lower or Silver Ledge are silica, barium, antimony, copper, and silver; and of the upper or Gold Ledge, are realgar, cinnabar, pyrite, and gold. Very careful assays of the unaltered limestones, shales and porphyries show that the precious metals are very generally present in appreciable amounts; but the Silver Ledge contains only a trace of gold and the Gold Ledge practically no silver. The silver ores are especially distinguished by the fact that they do not contain a trace of lead. Complete analyses by Dr. Hillebrand, embracing over twenty determinations in each case, are given for the silver ore and for both the unoxidized and oxidized gold ores. The chapters on the origin of the ores are replete with interest for the student of chemical geology. The silver ores are regarded as aqueous deposits, but not as the product of a general aqueous circulation. The water which was intimately combined with the porphyry at the time of its eruption and was perhaps the motive cause of the eruption was separated from the lava at the moment of cooling and found its way into the adjoining rock. Being still intensely heated, and carrying in solution many of the chief elements of the eruptive mass, it exerted for a brief period a powerful altering force on the easily soluble limestone, and in the course of this alteration the ores were deposited. The mineralization of the Gold Ledge took place at a distinctly later period than that of the Silver Ledge, and the general nature of the phenomena indicates that the agents were gaseous rather than liquid; that they ascended along the open vertical fissures, probably from some uncooled body of igneous rock below, and impregnated the zone at the lower contact of the porphyry sheet, which was already altered and porous from the effects of the earlier Silver Ledge mineralization, with arsenic, mercury, and gold. The fact that the chief associated minerals of the gold are realgar and cinnabar, and that the gold itself was probably first deposited as the telluride, is regarded as a striking confirmation of this view.

On the Occurrence of Vanadium in Scandinavian Rutile. By B. Hasselberg. *Astro-Phys. J.*, 5, 194–198.—The presence of vanadium was unexpectedly discovered in samples of the mineral rutile, from both Norway and Sweden, from a careful study of the spectrum obtained by the volatilization of the above mineral in the arc. Whether the amount present is sufficient for analytical determination remains an open question.

GENERAL AND PHYSICAL CHEMISTRY.

A. A. NOYES, REVIEWER.

A Revision of the Atomic Weight of Magnesium. BY THEODORE WILLIAM RICHARDS AND HARRY GEORGE PARKER. *Proc. Am. Acad. Arts and Sci.*, **32**, 55–73.—Three samples of magnesium ammonium chloride were prepared by somewhat different processes, great care being used to remove all impurity. Portions of this salt were then gradually heated to redness in a platinum boat in a combustion tube in a current of dry hydrochloric acid, and the residual magnesium chloride was allowed to cool either in that gas or in dry nitrogen, which was then displaced by dry air. The apparatus was so arranged that the platinum boat could be pushed into a weighing tube and the glass stopper of the latter inserted within the combustion tube without exposing the salt to the air. The salt, after weighing, was dissolved in water. In one series of experiments an excess of silver nitrate was added, and the precipitated silver chloride was collected and weighed. In three other more reliable series the ratio, $MgCl_2 : 2Ag$, was determined by adding to the salt a nearly equivalent weighed amount of pure silver dissolved in nitric acid and estimating the slight excess of silver or chlorine in the liquid after allowing the precipitate to settle by comparative measurements of the degree of opalescence produced by adding to separate portions of it minute quantities of silver nitrate and ammonium chloride. The first three series of experiments consisting respectively of five, three, and five determinations gave 24.369, 24.380, and 24.365 as the atomic weight referred to oxygen as 16. The fourth series, consisting of six determinations, was made with even greater precautions than the preceding ones, two distinct samples of magnesium chloride and three of silver being employed. The results obtained are 24.360, 24.364, 24.362, 24.362, 24.363, and 24.363, giving as a mean 24.362, which the authors adopt as the final value of the atomic weight. This brief summary of the results is a sufficient comment on the wonderful accuracy of the work.

The Velocity of the Reaction between Ferrous Chloride, Potassium Chlorate, and Hydrochloric Acid. BY A. A. NOYES AND R. S. WASON. *J. Am. Chem. Soc.*, **19**, 199–210.—The authors present nine series of measurements which show that the reaction is one of the *third order*, its velocity being directly proportional to the concentration of each of the three substances; also six series on the effect of varying the temperature between 0° and 50°. It is shown that the latter effect can be expressed by the thermodynamical logarithmic equation of van't Hoff, whose applicability to several other reactions has already been demonstrated by Arrhenius. The effect is one of the same order of magnitude as that in the case of other actions already investigated.

A Recalculation of the Atomic Weights. By Frank Wigglesworth Clarke. *Smithsonian Miscellaneous Collections*, 1075, 1–370.—This valuable publication is a presentation and critical discussion of all the existing data relating to the combining weights of the elements.

Mercuric Chloride. By D. McIntosh. *J. Phys. Chem.*, 1, 298–300.—In explanation of the observation of Etard that the solubility of mercuric chloride in methyl alcohol is represented by two distinct curves intersecting at about 38°, the author has investigated the nature of the salt separating from the solution above 40° and below 35°. Above the former temperature small compact crystals consisting of the pure salt separate; while below 35° needle-like crystals form, which are shown, by analysis and by determining whether heat is produced or absorbed by the successive addition of varying quantities of alcohol to the salt, to have the composition $HgCl_2.CH_3OH$. The transition temperatures in pure methyl alcohol and in mixtures of it with water were determined by observing with the eye the point at which the needle-like crystals first make their appearance, and by noting the point during the cooling of the solution at which the thermometer reading remains constant for an appreciable interval of time. The results are tabulated.

Mass Law Studies, I. By S. F. Taylor. *J. Phys. Chem.*, 1, 301–303.—The author has determined at 20°, 25°, and 35° the quantities of water which can be added to various mixtures of alcohol and benzene, and the quantities of benzene which can be added to mixtures of alcohol and water, before separation into two layers takes place. The results differ widely from those previously obtained by Bancroft at 20°. The publication of two such discordant series of results from the same laboratory without any attempt to explain the discrepancy seems to the reviewer unjustifiable.

Quintuple Points. By Wilder D. Bancroft. *J. Phys. Chem.*, 1, 337–343.

Solids and Vapors, II. By Wilder D. Bancroft. *J. Phys. Chem.*, 1, 344–348.—Compare *this Rev.*, 2, 36.

Distillation with Vapor. By C. H. Benedikt. *J. Phys. Chem.*, 1, 397–402.—The author cites numerous previous observations showing that non-volatile substances are present in vapors in much larger amounts than would correspond to their vapor pressures, and he describes an experiment of his own in which he distilled a saturated solution of naphthalene in ether in contact with solid naphthalene, analyzed the distillate, and found it to contain a proportion of naphthalene corresponding to a partial vapor pressure of 37 mm., which is more than four times greater than the vapor pressure of pure naphthalene. The author suggests that this may be due to an increase in the vapor pressure of the dissolved substance by the solvent or to a solubility of it in the vapor. The result of the author's experiment seemed so improbable, considering its discordance with the established laws of the vapor pressure of solutions, that the reviewer was led to repeat it; and he was not surprised to find that the distillate passing over between 62° and 82° (the thermometer-bulb being in the liquid) from a concentrated solution of naphthalene in ether left on evaporation at the ordinary temperature about 0.1 per cent. of the former substance instead of 8.8 per cent. as found by the author.

Two Liquid Phases, I. BY WILDER D. BANCROFT. *J. Phys. Chem.*, 1, 414–425.

A Triangular Diagram. BY WILDER D. BANCROFT. *J. Phys. Chem.*, 1, 403–410.—The author discusses the plan proposed by Roozeboom for representing, by means of an equilateral triangle the variations in composition of a phase consisting of three components.

Cuprous Chlorid. BY J. K. HAYWOOD. *J. Phys. Chem.*, 1, 411–413.—Lescoeur has previously shown that cuprous chloride is partially decomposed by water into cuprous oxide and hydrochloric acid, and that successive portions of wash water contain equal quantities of hydrochloric acid until the chloride is completely converted into the oxide, a result in complete accord with the laws of equilibrium. The author has repeated the experiments; and he concludes from his own results that those of Lescoeur were purely accidental and due to the fact that the conditions under which the successive treatments of the chloride with water were made were so nearly identical. It is difficult to see how this could have been the case; for Lescoeur continued the washing until the chloride was entirely decomposed, so that the amount of it in contact with the water must have steadily diminished.

A Contribution to the Study of Water Solutions of Some of the Alums. BY HARRY C. JONES AND E. MACKAY. *Am. Chem. J.*, 19, 83–118.—The article begins with a brief summary of the previous work relating to the composition of double salts in solution. The authors next describe, as preliminaries to their investigations, a convenient apparatus for the preparation of pure water for conductivity measurements, and a volumetric method of determining aluminum. To prepare the pure water ordinary distilled water, to which potassium permanganate and sulphuric acid are added, is distilled from a large flask into a tubulated retort turned upwards containing an alkaline permanganate solution which is itself kept boiling, so that a continuous distillation occurs; joints are made with asbestos paper and a tin tube serves as a condenser. The authors determined the molecular conductivity of potassium, aluminum, and chromium sulphates and of six of the aluminum, chromium, and iron alums, at dilutions varying from 3 to 4000 liters. It was found that in dilute solutions the alums have a conductivity which is almost exactly the mean of the conductivities of their constituents; but that in more concentrated solutions (0.2—0.025 molecular weight per liter) the conductivity is somewhat less (9.2 per cent. in one case) than the mean. The authors have also determined the freezing-points of the solutions of the same salts, and find that the lowerings caused by the alums are in the more concentrated solutions 10-11 per cent. less than the sum of those of their constituents. The authors consider the differences both of conductivity and freezing-point to be greater than can reasonably be accounted for by the change in electrolytic dissociation of the salts on mixing, and conclude therefore that undissociated alum molecules probably exist to some extent in the more concentrated solutions, but that they are completely broken up in the more dilute solutions. Incidentally the authors have found that the very dilute solutions of the alums increase in electrical conductivity with time, a phenomenon already observed and discussed by Goodwin (*this Rev.*, 3, 22) in the case of ferric chloride.

H. M. GOODWIN, REVIEWER.

The Multiple Spectra of Gases. BY JOHN TROWBRIDGE AND THEODORE WILLIAM RICHARDS. *Am. J. Sci.*, 153, 117–110.—The interesting investigations of the authors on the dual spectra of argon under the influence of a continuous and oscillatory discharge are extended in this paper to nitrogen, hydrogen, the halogens, and helium. The method employed is that previously described (*this Rev.*, 3, 22). A continuous discharge in nitrogen caused the gas to glow with a delicate pink light, and gave rise to a channelled spectrum. Introduction of a gap across which a brush discharge took place caused the glow in the capillary to become more blue, and the red lines in the spectrum to disappear. Introduction of a condenser, whereby the unidirectional was changed to an oscillatory discharge, caused a complete change in the appearance of the discharge; the glow became bluish green, and the spectrum changed to the well-known bright-line spectrum of nitrogen. By gradually damping the oscillations by the introduction of a resistance or inductance in the circuit, the first spectrum gradually reappeared. The same was true of hydrogen; the usual four line spectrum is produced only by an oscillatory discharge; a continuous discharge causes the red glow in the capillary to change to white, and the spectrum to change to one composed of very many fine lines among which are the four characteristic hydrogen lines, by no means especially prominent however. The halogens likewise give two spectra according to the nature of the discharge producing them. With helium the difference of the two spectra is less marked. The bearing of the results on astro-physical problems is pointed out. The work is being extended to other gases under varying conditions of temperature and pressure.

The Temperature and Ohmic Resistance of Gases During the Oscillatory Electric Discharge. By John Trowbridge and Theodore William Richards. *Am. J. Sci.*, 153, 327–342.—The resistance which a rarified gas offers to the passage of an oscillatory discharge is very much less than that which it offers to a unidirectional one. The authors have determined the resistance of a Plücker's tube to an oscillatory discharge in the following way. Many hundred photographs of the oscillatory sparks of condensers of different capacities discharged through variable known resistances were taken as viewed in a very rapidly revolving mirror. A curve was then constructed with resistances as abscissae and the corresponding number of half oscillations determined from the photographs as ordinates. Plücker tubes were then substituted for the known resistances, and the spark again photographed. From the number of oscillations thus determined, the corresponding resistance of the tube was interpolated from the plot. The results of a large number of experiments with nitrogèn and hydrogen are summarized as follows: 1. The resistance of a gas at low pressure to the oscillatory discharge is very small (5 to 10 ohms). 2. The resistance is in general greater, the less the quantity of electricity. 3. Down to a very small pressure this resistance decreases with the tension of the gas. 4. The form of the tube has an important effect on the resistance of the gas. 5. With the oscillatory discharge it is evident that the electrodes produce far less effect than with the continuous discharge.—The authors then discuss the cause of the different types of spectra produced by direct and oscillatory currents, favoring the view that the continuous discharge is the result of a "polarized condition in which the molecules are in some way bound together by the electric energy striving to force itself through them," while the oscillatory discharge is accompanied by dissociation of the molecules. For the production of such dissociation an enormously high temperature is required, which, however, is entirely outside the bounds of measurement, owing to the brief period of the discharge. Bolometric measurements in a vacuum tube gave no indication of what this may be, as in such measurements only the mean temperature of the gas in the neighborhood of the bolometer is measured. The reviewer would raise the question whether the color and spectrum of a discharge may not be the result of a transformation of electrical energy into radiant energy, either directly or perhaps intermediately through chemical energy, rather than of a very high temperature arising from the transformation of the energy of the discharge into heat, especially in view of Pringsheim's experiments on heated gases and vapors, which go to show that gases cannot be brought to incandescence by heat alone.

Does a Vacuum Conduct Electricity? BY JOHN TROWBRIDGE. *Am. J. Sci.*, 153, 343.—This question, which was answered affirmatively by Edlund, and more recently negatively by J. J. Thomson, is again considered in the light of the author's recent experiments on vacuum discharges. The principal resistance encountered in a high vacuum discharge resides at the boundary of the electrodes and the medium. When once this resistance is overcome and a discharge passes through the tube, the resistance of the tube to subsequent oscillations is equivalent to only a few ohms. The author concludes that the resistance of the Crookes' tube to a disruptive discharge diminishes as a perfect vacuum is approached. It should be remembered, however, that the actual resistance offered by a so-called "absolute vacuum" to the *initial* discharge increases almost indefinitely with the vacuum, and that only after a discharge has once passed and broken down the medium, thus presumably modifying in some way the residual gas in the tube, is the resistance reduced for succeeding discharges to the low value measured by Prof. Trowbridge.

The Influence of a Static Charge of Electricity upon the Surface Tension of Water. BY E. L. NICHOLS AND T. A. CLARK. *Phys. Rev.*, 4, 375–388.—The surface tension of water was determined under different states of electrification by the method of drops. The potential to which the water was raised was measured by means of a modified form of Henley electrometer; and the temperature of the drops as they fell from the dropper measured by means of a thermo-element. It was found that the surface tension diminished—at first slowly, but above 6000 volts rapidly—with increasing voltage. This result was found to be independent of the sign of the charge; and preliminary experiments indicate that the same relations hold true for other liquids than water.

The Lead Cell. By B. E. Moore. *Phys. Rev.*, 4, 353–374.—The theory of accumulators as given by Le Blanc in his *Lehrbuch der Electrochemie* is accepted by the author and reproduced in some detail. A number of experiments on the electromotive force of accumulators during charge and discharge were made at noted intervals of time, particularly immediately after the closing of the circuit, the results being represented graphically. A very rapid change of the electromotive force was noticed during the first few seconds of each run, which is probably due to changes in concentration at the electrodes. The currents used ranged from 10 to 20 amperes, but the current density is not stated. For further discussion of the results, which the author considers to be in agreement with the theory, the reader is referred to the original article. The reviewer would remark that in the valuable paper by Tower on Peroxide Electrodes (*Ztschr. Phys. Chem.*, **18**, 17), which has evidently been overlooked by the author, we have the most satisfactory theory yet offered of the positive (peroxide) electrode of the cell while the negative electrode consisting of Pb and $PbSO_4$ in H_2SO_4 is simply a reversible electrode of the second kind, the theory of which is also well established (Goodwin, *Ztschr. Phys. Chem.*, 13, 62·1).

Empirical Formulae for Viscosity as a Function of Temperature. By A. Wilmer Duff. *Phys. Rev.*, 4, 404–410.—To obtain a formula expressing the dependence of viscosity on temperature for wide ranges of temperature the author integrates the equation:—$\eta\frac{dt}{d\eta} = a + bt + ct^2$ (the equation of the "subsidiary curve of subtangents"), and obtains the following formulæ containing four constants · $\eta = c\left(\frac{t+\alpha}{t+\beta}\right)^n$ and $\eta = c\,a^{-\overset{-1}{\tan}\,\alpha(t+\beta)}$. These formulas are tested with the data of Thorpe and Rodger and those of others. That the agreement should be better than can be obtained with a three-constant formula is self-evident.

Sulfur and Toluene. By J. K. Haywood. *J. Phys. Chem.*, 1, 232–233.—The boiling-points of toluene and of xylene were found to be raised about 2° and 4°, respectively, by the addition of an excess of sulphur.

An Examination of the Abegg Method of Measuring Freezing-Point Depressions. By E. H. Loomis. *J. Phys. Chem.*, 1, 221–232.—The examination consists for the most part of a comparison of the author's method and results with those recently published by Abegg. Abegg's method is regarded as entirely free from objections in principle and "marks a positive advance in freezing-point methods:" but that it may be used to better advantage, the author emphasizes the necessity of making a larger number of independent determinations of each solution than Abegg has done in order to eliminate the indeterminate errors which a consideration of his results shows to be present. It is pointed out that the apparent constancy of Abegg's freezing temperatures as indicated by the constancy of his thermometer within 0.0001° for hours at a time, is undoubtedly due to the "inertia" of the mercury thread in the thermometer, and not to an actual constancy of temperature to this amount; for from the experience of the author the most sensitive thermometers do not respond to temperature changes of several ten-thousandths of a degree, when once the thread has become stationary.

Osmotic Pressure and Variance. BY J. E. TREVOR. *J. Phys. Chem.*, 1, 349–366.—In this paper Gibbs' Phase rule expressed in the form $v = n + 2 - r$, where n is the number of independent substances present, r the number of phases, and hence v the degree of freedom or "variance" (according to the terminology of the author) of the system, is extended to systems containing any number of semi-permeable walls, or in other words, any number of phases in which the osmotic pressure varies from phase to phase. The general criterion is arrived at by the specific consideration of a number of simple and rather complicated systems, and may be formulated as follows: $v=n+2+x+y-r$, where v, n and r have the same significance as above, x is the number of additional pressures due to the introduction of x osmotic walls, and y the number of separations of a component by a wall impermeable to it. For example in the system: solution, vapor, solvent, we have two independent chemical substances n, three phases r, one wall x, and no "separation," as the dissolved substance is present on but one side of the wall; hence the system has two degrees of freedom, or is divariant, since $v=2+2+1+0-3=2$. Again, in the system: solution, solid salt, vapor, solution; we have $n=2$, $r=4$, $x=1$, and $y=1$, since the wall is impermeable to salt and it is present on both sides. This system is therefore divariant, since $v=2+2+1+1-4=2$.

A New Formula for the Wave-Lengths of Spectral Lines. BY J. J. BALMER. *Astro-Phys. J.*, 5, 199–209.—The author proposes the formula: $\lambda_n = a\frac{(n+c)^2}{(n+c)^2-b}$ or $\tau_n = A - \frac{B}{(n+c)^2}$ for representing the line series of different spectra where a, b, c, A, B are constants, λ_n the wave length, and r_n its reciprocal. The claims made for the new formula are its simplicity and the fact that it is a closed function and not an abridged series (Kayser and Runge), and therefore that it more probably (?) represents the natural law underlying spectral phenomena. The formula is tested on the helium lines. The proposed formula is nearly identical with that proposed by Rydberg several years ago, as noted in an appendix.

Inner Thermodynamic Equilibria. BY J. E. TREVOR. *J. Phys. Chem.*, **1**, 206–221.—The author discusses at some length the interpretation to be given to the several terms in the integral expression: $\varepsilon' = t\eta' - pv' + \Sigma\mu m'$ for the energy of a phase and to the terms resulting from its complete differential; $d\varepsilon = td\eta - pdv + \Sigma\mu dm + \eta dt - vdp + \Sigma m d\mu$. While the first three terms of this equation refer to external energy changes involved by a change in the system, the last three refer to internal energy changes alone and for all reversible changes of state their sum is equal to zero. The article presents in a clear manner the relation to one another of the various forms of thermodynamic potential functions used by different writers. The views set forth are stated to be substantially the same as those published by L. Natanson in 1891 (*Wied. Ann.*, **42**, 178).

ANALYTICAL CHEMISTRY.

ULTIMATE ANALYSIS.

H. P. TALBOT, REVIEWER.

The Mechanical Analysis of Basic Phosphatic Slags. BY H. W. WILEY. *J. Am. Chem. Soc.*, **19**, 19–22.—The paper opens with a short sketch of the earlier literature relating to basic slags and the methods of their valuation. To bring about a mechanical analysis of the slags, the author proposes to agitate them vigorously with ninety per cent. alcohol. The particles remaining suspended for five minutes are separated, then those after a further interval of two and a half minutes, and the residue is sifted, using sieves with meshes one-tenth and one-quarter of a millimeter. The first two "separates" contain both the highest total and the highest available phosphoric acid. The data suggest that a partial separation, might advantageously be made by the manufacturers of basic slags, for the purpose of obtaining a more concentrated fertilizing material.

Improvements in the Colorimetric Tests for Copper. BY GEORGE L. HEATH. *J. Am. Chem. Soc.*, **19**, 24–31.—Standard ammoniacal copper solutions which are permanent for long periods, may be prepared by replacing nitric acid by sulphuric acid after the solution of the pure copper in the former, provided a considerable excess of ammonia is added and the solution preserved in bottles with stoppers sufficiently tight to prevent any escape of ammonia. In the analysis of lean material for copper, a double precipitation of the iron and alumina by ammonia is found to yield better results, and in less time than either the precipitation by aluminum, or a single precipitation by ammonia.

Some Present Possibilities in the Analysis of Iron and Steel. By C. B. Dudley. *J. Am. Chem. Soc.*, 19, 93–108.—The paper gives a concise statement of the present attainments, both with respect to rapidity and accuracy, in the determination of carbon, graphite, silicon, sulphur, manganese and phosphorus in irons and steels. Valuable suggestions are also made respecting those points wherein these methods are still unsatisfactory, and upon which more research is desirable.

The Determination of Sulphur in Pig Iron. By A. A. Blair. *J. Am. Chem. Soc.*, 19, 114–115.—The author finds four kinds of sulphur in pig iron, the fourth being of a sort unacted upon by aqua regia, but oxidized by a fusion of the residue from the aqua regia with potassium nitrate. Bamber's method (*J. Iron Steel Inst.*, 1, 319) is recommended for the determination of sulphur in pig irons.

A Rapid Method for the Determination of Silicon in Silico-Spiegel and Ferro-Silicon. By C. B. Murray and G. P. Maury. *J. Am. Chem. Soc.*, 19, 138–139.—The finely crushed and sifted sample is dissolved in hydrochloric and sulphuric acids, the solution evaporated until only sulphuric acid remains, the ferric sulphate dissolved in hydrochloric acid. The silica is removed by filtration and tested with hydrofluoric acid. The operation may be completed in thirty minutes.

A Method for the Complete Analysis of Iron Ores, with Notes on Särnström's Method of Determining Manganese. By George Auchy. *J. Am. Chem. Soc.*, 19, 139–153.—The author makes suggestions as to the principles involved in the Särnström method of separating iron and manganese, and proposes certain modifications. A procedure for an analysis of an iron ore involving the Särnström separation is given in detail, and additional comments are made on the determination of phosphorus in steel and cast iron. Compare also *J. Am. Chem. Soc.*, 17, 943; 18, 228; 18, 385; 18, 498.

Standard Iodine for Sulphur Determinations. By Edward K. Landis. *J. Am. Chem. Soc.*, 19, 261.—The author works out a simple stoichiometrical calculation (such as could be made by any intelligent chemist), to find the quantity of a potassium permanganate solution necessary to liberate such an amount of iodine as will react with 0.5 gram of sulphur in the form of sulphuretted hydrogen.

W. H. WALKER, REVIEWER.

Is Alcohol a Source of Error in Volumetric Analysis? BY LYMAN F. KEBLER. *Am. J. Pharm.*, **68**, 667–675.—The answer to this question is of considerable importance when the value of alkaloids and alkaloidal residues is to be determined volumetrically. The "commercial alcohol" used by the author in this investigation was colorless, free from residue and foreign odor and of specific gravity 0.8179 at 15°. Solutions of Brazil wood, cochineal, haematoxylin, iodo-eosin, fluorescein, lacmoid, litmus, methyl orange, tropaeolin OO, phenolphthalein and rosolic acid were prepared in the usual manner, and five drops were taken as indicator for each titration. A tenth-normal sulphuric acid and a fiftieth-normal potassium hydroxide solution were then prepared, using haematoxylin as indicator, and after establishing the end-reaction with the other indicators, a set of experiments was carried out to determine the volume of the alkali solution required to neutralize a given volume of the acid solution when mixed with 50 cc. of water with diluted commercial alcohol, and with 94.5 per cent. commercial alcohol. The tabulated results conclusively show that with all the above indicators the commercial alcohol exerts a disturbing influence. This alcohol was then purified by fractionation, after treating successively with potassium hydroxide, tartaric acid, and silver nitrate; and its influence was investigated. The results show that in the experiments made with the commercial alcohol the disturbing action was due to some impurity; for the data obtained with the pure alcohol vary so little from those obtained from pure water, that, except with the indicators tropaeolin and methyl orange, the difference may be attributed to experimental errors. In the case of tropaeolin and methyl orange the stronger alcoholic solutions so interfere with the delicacy of the end-reaction as to render the results unreliable. Iodo-eosin and fluorescein also appear to be affected, but their end-reactions are so indistinct at best that little importance is attached to these variations. With the exception of the four indicators last named, the author thinks it safe to conclude that pure alcohol does not vitiate the accuracy of the volumetric determinations, but that commercial alcohol must be rigidly excluded.

[CONTRIBUTION FROM THE MASSACHUSETTS INSTITUTE OF TECHNOLOGY.]

REVIEW OF AMERICAN CHEMICAL RESEARCH.

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ARTHUR A. NOYES, Editor; HENRY P. TALBOT, Associate Editor.

REVIEWERS: Analytical Chemistry, H. P. Talbot and W. H. Walker; Biological Chemistry, W. R. Whitney; Carbohydrates, G. W. Rolfe; General Chemistry, A. A. Noyes; Geological and Mineralogical Chemistry, W. O. Crosby; Inorganic Chemistry, Henry Fay; Metallurgical Chemistry and Assaying, H. O. Hofman; Organic Chemistry, J. F. Norris; Physical Chemistry, H. M. Goodwin; Sanitary Chemistry, E. H. Richards; Technical Chemistry, A. H. Gill and F. H. Thorp.

ANALYTICAL CHEMISTRY.

ULTIMATE ANALYSIS.

W. H. WALKER, REVIEWER.

The Determination of Copper and Nickel in Smelter Matte. BY TITUS ULKE. *Eng. Min J.*, 63, 164.—The sample is dissolved in a mixture of sulphuric and hydrochloric acids with the subsequent addition of a little nitric acid, and, after one evaporation to dryness, is redissolved in water and the copper determined by electrolysis with a current of one-fourth of an ampere. For the determination of nickel, the iron is separated by repeated precipitations with ammonia, and the nickel thrown out of the strongly ammoniacal solution at a temperature of 70°, by a current of two amperes.

Blast Furnace Cinders and Their Analysis. BY J. M. CAMP. *Proc. Eng. Soc. Western Pa.*, 13, 18.—This paper, though very comprehensive, does not claim to contain anything that has not already appeared in chemical literature.

A Rapid and Practical Method for Determining Carbon in Iron. BY J. GEORGE HEID. *Eng. Min. J.*, 63, 64.—The sample is treated with copper ammonium chloride in the usual manner, and the separated carbon is collected on an asbestos filter, where it is washed successively with water, alcohol, and ether; it is then transferred to a Rose crucible, dried at 120°, and weighed. A stream of oxygen is led into the crucible which is heated over a Bunsen flame, and the carbon is thus burned off in from three to five minutes; the difference in weight is the "total carbon." The "graphitic carbon" is obtained by dissolving the iron in dilute hydrochloric acid and determining the separated carbon as before.

PROXIMATE ANALYSIS.

F. H. THORP, REVIEWER.

Improvements on Dr. Squibb's Volumetric Method for Estimating Acetone. BY LYMAN F. KEBLER. *J. Am. Chem. Soc.*, **19**, 316.—The author found Squibb's method (*J. Am. Chem. Soc.*, **18**, 1068) unsatisfactory in two ways: a pure acetone must be used, which is not readily obtainable; and the end-reaction is too slow. After explaining his modified process, the author gives a table of comparative results by the methods of Messinger, Squibb, and himself, showing that Squibb's method gives results lower than his own.

G. W. ROLFE, REVIEWER.

The Quantitative Determination of Carbohydrates in Food-Stuffs. BY W. E. STONE. *J Am. Chem. Soc.*, **19**, 183–197.—The author gives a detailed account of his method of separation and determination of the various carbohydrates in our common cereals and their products. The separations are all made in one sample, and the author claims an advantage of rapidity and convenience over previous methods. Many of the descriptions of processes, especially that of starch determination, are somewhat vague. The omitted details of the discrimination between invert sugar and other sugars, dextrin and "soluble starch," would not have been so trite as to be devoid of interest. Much of the subject-matter given has been previously published.

The Quantitative Determination of Carbohydrates in Food-Stuffs, II. BY W. E. STONE. *J. Am. Chem. Soc.*, **19**, 347–349.—The author draws attention to the obvious error in the starch estimations of his previous publications already referred to in these pages. He still finds a noticeable weight of the grain unaccounted for in his corrected analyses. The reviewer trusts that he will not be misunderstood when he reiterates that a more complete explanation of methods and more data should be given in the description of starch analyses. In no class of analyses does there exist more confusion, not only in methods of manipulation but of calculation, than in that of starch and starch products. Thousands of analyses become valueless simply from lack of published data that are absolutely necessary as a basis of comparison and correction. In the interests of science no space should be begrudged to this end.

Notes on an Analytical Investigation of the Hydrolysis of Starch. BY G. W. ROLFE AND GEO. DEFREN. *J. Am. Chem. Soc.*, **19**, 261–262.—The authors call attention to important errors of calculation and misprints in recently published papers. They also give a few additional deductions from the original data.

A. H. GILL, REVIEWER.

A Technical Analysis of Hydrocarbons, Vapors, and Gases in Literature and Laboratory. BY W. H. BIRCHMORE. *Am. Gas Lt. J.*, **66**, 445–446 and 478–480.—The author reviews briefly the various methods for gas analysis in use from 1875 to the present time, and states that the best description of these methods is given in *Thorpe's Dictionary of Applied Chemistry.*

Heat of Bromination as a Means of Identifying Fats and Oils. BY BROMWELL AND MAYER. *Am. J. Pharm.*, **69**, 145.—The authors have applied the method of Hehner and Mitchell, modified by Wiley, to many different oils. They use a tube jacketed with cotton and calcined magnesia, and use the oils and bromine in chloroform solution.

A Brief Resume of Acetic Anhydride in Oil Analysis and a Modification of the Method for Estimating Menthol in Oil of Peppermint. BY L. F. KEBLER. *Am. J. Pharm.*, **69**, 189–195. —The determination of the combined menthol is effected by submitting 10–12 grams of the oil to the Koettstorfer test. Each cubic centimeter of normal sodium hydroxide solution is equivalent to 0.156 grams of menthol in combination as an ester. For the total menthol, 10–12 grams of oil are subjected to the usual acetylating process, and treated as above. By deducting the amount of menthol in the form of esters from the total quantity found, the amount of free menthol is obtained. The process can be easily carried out in three hours. The author states that in the examination of oil of peppermint the following points should be taken into consideration :

(1) Specific gravity at 15° C., which in the eight samples examined varied from 0.9065 to 0.9147 ; (2) the boiling-point, which varied from a little below 200° C. to about 230° C. ; (3) amount of menthol. The combined menthol varied from 3 to 16 per cent., the total from 30 to 80 per cent. These data, together with the aroma and identity tests, will show the character of almost any sample.

TECHNICAL CHEMISTRY.

F. H. THORP, REVIEWER.

Manufacture of Albumen at Chinkiang. BY A. C. JONES. *U. S. Consular Rep.*, 53, 386.—This deals with the preparation of albumen from ducks' eggs. The eggs are broken and the yolks separated from the whites. The whites are then stirred until uniformly mixed, and then dried in shallow tin pans, at a temperature of 40° to 50° C. The drying occupies about 70 hours. Sometimes the albumen is put into vats and allowed to ferment, the process being hastened by the addition of some chemical, the nature of which is not revealed. The impurities rise in the froth, or settle to the bottom, and the clear albumen is drawn off and dried as above. The yolks are stirred through sieves and then mixed with salt, borax, and other chemicals. The thick, orange-colored liquid is filled into barrels and shipped. Its chief use is in the leather industry, for dressing. The chemicals used in preparing the albumen and yolk are said to be salt, borax, acetic acid, ammonia, boracic acid, and calcium chloride, but the quantities used and the methods of their employment are not stated.

Asphalt and Asphalt Pavements. By GEO. W. TILLSON. *Proc. Am. Soc. Civil Eng.*, 23, 179–199.—Regarding the composition of asphalt, the author quotes Peckham, Boussingault, and Endemann. The geographical distribution of asphalt deposits is also shown, followed by an account of the methods of obtaining and refining Trinidad, California, Bermudez, Utah, Kentucky, Indian Territory, and European asphalts; their physical properties are given, and in most cases also the chemical composition, but no authorities are quoted for the analyses. The greater part of the paper is devoted to the use of asphalt for pavements, and this is treated from the engineering and not from the chemical point. The author holds that a chemical analysis is of no particular assistance in forming an opinion of the suitability of an asphalt for a given pavement; it may however be of value in determining the amount of flux to be added for any given purpose. The refined asphalt should contain 50 to 60 per cent. of bitumen, which should be composed of about 75 per cent. petrolene, and 25 per cent. asphaltene.

Notes on Portland Cement Concrete. By ANDREAS LUNDTEIGEN. *Proc. Am. Soc. Civil Eng.*, 23, 135.—The author discusses the advantages derived from the addition of finely powdered siliceous material to Portland cement for concrete. He quotes Michaëlis to the effect that a large part of the lime in Portland cement is set free during the hardening, and also concludes from his own observations that this is true. The lime thus set free, may take up carbon dioxide from the air and is then rendered non-injurious, or it may be dissolved away by water, leaving the concrete porous, or in case sea-water reaches the concrete, the salts it contains will combine with the calcium hydrate to form double salts, which crystallize, or swell, and cause disintegration of the concrete. The author recommends the addition of a siliceous material which he calls *sil.* It is a volcanic ash from Nebraska, Colorado, and other places. Analysis shows its percentage composition to be: Silica, 71.78; titanic acid, 0.80; alumina, 12.71; iron oxide, 2.29; magnesia, 0.35; lime, 1.01; water of constitution, 4.52; alkalies (by difference), 6.54. Ash containing a large amount of water of constitution, is considered best for this use. The siliceous material combines with the free lime. Numerous tables showing the effect of such additions are given. The ultimate strength appears to be considerably increased.

European Portland Cement Industry. BY FREDERICK H. LEWIS. *Eng. Record*, 35, 312, 334, 378, 403, 444, 466.—This paper gives a description of several manufacturing establishments visited by the author while traveling abroad.

A. H. GILL, REVIEWER.

Analysis of Popo Agie, Lander and Shoshone Petroleum. BY E. E. SLOSSON. *Univ. Wyom. Bull.*, 2, 21–34.—About 60 kilograms of the Popo Agie oil were distilled, and collected in 52 fractions, the flashing and burning points, and the specific gravity of each of which were determined. Another sample was treated similarly, except that superheated steam was introduced after the kerosene had distilled off, which produced a larger proportion of products similar to lubricating oils. The results of the experiments seem to indicate that the commercial products would be, in percentages, about as follows: Naphtha, 2–5; kerosene, 30–40; lubricating oil, 35–50; paraffin, 3–5; coke, 7–10; and gas, 10–12. Lander petroleum is much lighter than the usual Wyoming oils, while Shoshone petroleum is very heavy, and, like the Popo Agie, contains sulphur.

The Presence of Hydrogen, Hydrocarbons, and Nitrogen Peroxide in Boiler Furnace Gases. BY R. S. HALE. *Eng. News*, 37, 107.—The author points out the fact that the absence of carbon monoxide is not a proof of the absence of free hydrogen or hydrocarbons. He shows that oxygen has a greater attraction for carbon than hydrogen at temperatures about 600° C. In calculating the distribution of the oxygen entering the grate nearly 0.8 per cent. frequently remained unaccounted for. It was thought this might be due to the presence of oxides of nitrogen, and upon examination it was found that in one case 0.9 per cent. of oxides of nitrogen was actually formed.

The Calorific Value of Certain Coals as Determined by the Mahler Calorimeter. BY N. W. LORD AND F. HAAS. *Eng. News*, 37, 188–189.—The authors give the ultimate chemical analysis and heating value of forty samples of Ohio and Pennsylvania coals. The varieties were Upper Freeport, Ohio, Pittsburgh, Darlington, Hocking Valley, Thacker, West Va., Pocahontas, and Mahoning. To prevent portions of coal from being blown away by the oxygen, it was compressed into cylinders. The agreement of the calculated results by Dulong's formula with the calorimetric results is remarkable, the maximum difference being 2 per cent., and the minimum 0.1 per cent. This is a trifle greater than the results of which ultimate analysis would yield, the possible error of the latter being for hydrogen 0.5 per cent., for carbon 0.2 per cent. This would cause an error in substitution in the formula of 1.4 per cent. They could find no relation between the "fixed carbon" and the heating value, but they found that the coal from a given seam extending over considerable areas, may be regarded as essentially of uniform heating value.

Calorimetry. BY C. D. JENKINS. *Am. Gas Lt. J.*, **66,** 442.—The article gives the results of tests made with the Junker Gas Calorimeter on various gases, both coal and water. It suggests that the proper standard for comparison is gas saturated with moisture at 60° F. and 30 inches barometric pressure. The apparatus gave with hydrogen 326.8 B.T.U., as against 328.8 obtained by Berthelot.

Calorimetry and Heat Unit Value of Gases. BY F. B. WHEELER. *Am. Gas Lt. J.*, **66,** 518.—The author compares the calorific power of various gases obtained by calculation with those obtained by direct determination with a calorimeter. He uses for the theoretical calculation Thomson's figures expressed in English units (B. T. U.) as follows :

CO, 348; H, 349; { C_2H_4, 1673 } Usually figured as "Illu-
CH_4, 1065 ; C_6H_6, 4010; { C_3H_6, 2509 } minants" = 2000 B.T.U.

At 32° F. and 29.92 inches. To reduce the heat units thus found to the standard adopted in calorimetric work, *viz.*, gas saturated with moisture at 60° F. and 30 inches, multiply by 0.9298. It was found that the theoretical results agreed with the practical within about one per cent.

Comparative Tests of Light Secured and Operating Expense of the Welsbach Lights and Oil Lamps. BY H. D. WALBRIDGE. *Am. Gas Lt. J.*, **66,** 405.—It was found that the Welsbach burner gave 84.6 candle power per hour, at a cost of 0.3 cent for gas and 0.1 cent for mantles. A good oil lamp, with round wick with central draft, gave 30 candle power and cost 0.48 cents per hour; while the B. & H. oil lamp gave 37.5 candle power and cost 0.54 cent per hour. Gas was reckoned at one dollar per 1000 cubic feet, and kerosene 12 cents per gallon.

BIOLOGICAL CHEMISTRY.

W. R. WHITNEY, REVIEWER.

The Gelatin from White Fibrous Connective Tissue. BY WILLARD G. VAN NAME. *J. Expt. Medicine*, **2,** 117–129.—

The aim of the author has been to obtain a pure sample of one of the several probably distinct compounds known as gelatins, and to determine its chemical composition and properties, so that the exact relationship between gelatin and albumin may be made clear. As source of the gelatin the author chose the collagen of tendons from oxen. After extraction with water the finely ground material was treated with alkaline pancreatic juice. By this treatment tissue elements other than the collagen were dissolved. This was filtered from the solution, washed with water, and finally dissolved in boiling water. The concentrated gelatin solution was poured into a large volume of 95 per cent. alcohol and the precipitated product washed with absolute alcohol and with ether until it became brittle. It was then pulverized and extracted with ether to remove fat, dissolved in water, and again precipitated by alcohol, washed, etc., as before. The dried product was then analyzed. Samples were also prepared from ox tendons by three ways differing somewhat from the above. The results of the analyses of the different samples agree very well with one another, the average composition of the ash-free gelatin being: Carbon = 50.11, hydrogen = 6.56, nitrogen = 17.81, sulphur = 0.256, oxygen = 25.24, ash =0.325. The chemical properties of the four samples were found to be identical. Many of the characteristic reactions of pure gelatin are given, including a study of its precipitability by many acids and salts.

The Relative Strength of Antiseptics. BY LOUIS KAHLENBERG. *Pharm. Rev.*, **15**, 68–70.—After a brief historical account of the advance of the theories of solution, the author summarizes the valuable and instructive work of himself and True (*Botanical Gazette*, **22**, 181), and of Heald (*Botanical Gazette*, **22**, 125), upon the connection between the toxic action of aqueous acid, basic, and salt solutions upon various plants, and the condition of dissociation of these substances. The recently published work of Paul and Krönig (*Zeit. phys. Chem.*, Dec., '96), on the action of chemical reagents on bacteria is carefully reviewed. The author finds in this last, a confirmation of the views previously advanced by himself and True regarding the connection between electrolytic dissociation of compounds and their toxic or antiseptic action.

Formic Aldehyde; Its Practical Use. BY F. C. ROBINSON. *Maine State Board of Health, 9th Report*, 1–24.—In 1893, a German chemical manufactory put upon the market a 40 per cent. aqueous solution of formic aldehyde. which they called formalin, and for which very valuable disinfectant properties were claimed. It seemed possible that this new germicide might soon replace all others, both because of its powerful germicidal effect and of the safety to the ordinary furnishings of rooms, paintings, fabrics, etc., accompanying its use. Mr. Robinson has given the gaseous aldehyde a practical trial and ingeniously devised an effective form of lamp which produces the aldehyde in the room where its use is desired. The alcohol vapor is changed to aldehyde by glowing platinum-black deposited upon a perforated asbestos disk, which partly covers the vessel containing the alcohol. He states among other important facts, that the aldehyde from two liters of alcohol, in a room of 3000 cubic feet capacity, destroyed typhoid and diphtheria cultures even when these "were rolled up in a mattress and the whole tied into as compact a bundle as possible." Experiments with the aqueous solutions were also made, but the vaporizing treatment was more successful. The article contains two illustrations showing the construction of the lamp above mentioned.

A Chemical Study of the Secretion of the Anal Glands of Mephitis Mephitica (Common Skunk), with Remarks on the Physiological Properties of this Secretion. By Thomas B. Aldrich. *J. Expt. Medicine*, 1, 323–340.—The secretion was subjected to fractional distillation. The distillate of which the boiling-point was 100°–110° contained about 35 per cent. of sulphur and the author analyzed the mercaptides produced by addition of lead acetate, mercuric chloride, and mercuric oxide to alcoholic or ethereal solutions of this distillate. The results show the probable presence of primary normal butyl mercaptan, together with small quantities of higher mercaptans. That portion of the secretion boiling above 130° contains no mercaptans. The sulphur which it contains is thought to be combined with some basic nitrogen radical.

The Occurrence of Raffinose in American Sugar Beets. By W. E. Stone and W. H. Baird. *J. Am. Chem. Soc.*, 19, 116–124.—As the result of investigation of the non-crystallizing sirups from a Nebraska beet sugar refinery, the authors conclude that raffinose occurs in the juices of the American sugar beet in appreciable quantities. Photographic reproductions of crystals of pure sucrose, raffinose, and a mixture of the two show the marked effect of the presence of even a small proportion of the latter in causing the mixture to crystallize in elongated, sharp-pointed crystals, much more like those of pure raffinose than sucrose.

Marrubiin and Its Dichlorine Derivative. By Harry Matusow. *Am. J. Pharm.*, 69, 201–209.—The author reviews the work already done by Harms, Kromayer, Hertel, and Morrison, and then describes his own investigations. He details carefully the isolation and purification of marrubiin and describes its properties, both physical and chemical. Results of analyses made by him are given, which show that marrubiin is not a glucoside, as was formerly believed. He also describes his preparation of the dichlorine derivative of marrubiin, gives its composition as derived by analyses, and states its physical properties.

The Phenol-Content of the Oil of the Monarda Fistulosa (L). By E. J. MELZNER. *Pharm. Rev.*, 15, 86–87.—This article, which is a further contribution of the author's work on the Wild Bergamot oil, contains three tables of results. These show the percentage of phenol in a dozen samples, as determined volumetrically and by titration with iodine solution, also the yields of oil from given weights of stems, leaves, flowers, and fruit of the plant, together with the specific gravities of the oils obtained. Comparisons with results of previous years are also given.

The Presence of Starch and Strontium Sulphate in Opium and their Influence on Assaying. By LYMAN F. KEBLER AND CHARLES H. LAWALL. *Am. J. Pharm.*, 69, 244-250.—The authors have found these ingredients in samples of commercial opium and the fact that all cases examined in one consignment showed practically the same quantities of impurity, leads them to conclude that a " manipulation" of large quantities of opium occurs before it is packed in the cases. As the morphine present is always well above the legal requirements it would be interesting to know the reason for the adulteration, if such it is.

Gelsemium. By L. E. SAYRE. *Am. J. Pharm.*, 69, 234-235.—This may be considered as a conclusion of the author's previous article on the subject (*ibid.*, 69, 8-13). Analyses of the rhizomes, roots, and stems are given, showing that the gelsemine alkaloid, and gelsemic acid do not occur in the stem but only in rhizome and roots, so that admixture of the stems with the commercial roots is to be considered an adulteration.

Gelsemic Acid. By VIRGIL COBLENTZ. *Am. J. Pharm.*, 69, 228-231.—The author, after giving the brief history of this vegetable acid, points out an important source of error in previous analyses of the substance. He finds that a part of the carbon always separates in the combustion tube, in an incombustible graphitic form. Five different methods of combustion were tried and in none was the oxidation complete. A description of the wet combustion method using chromic acid in sulphuric acid, as employed by him, is then given, although this method also failed when gelsemic acid was analyzed. The analyses of bromo and acetyl derivatives, which were more successful, the author does not give, as he intends to study their molecular weights with an aim to determining their formulas.

Note on Phospho Cereal. By T. H. Norton. *Pharm. Rev.*, 15, 46.—Results of analyses of the so-called phospho cereal and its decoction are given. The sample contained 5.18 per cent. of phosphorus, calculated as P_2O_5. Of this about one-quarter was extracted by fifteen minutes' boiling with water and less than one-half in two hours. Phosphites and hypophosphites were not present in the decoction, all the phosphorus being present as phosphoric acid. By this latter expression is doubtless meant phosphate instead of free acid.

The Proteose of Wheat. By Thomas B. Osborne. *Am. Chem. J.*, 19, 236-237. Exceptions are taken to the statement of Teller (*ibid.*, 19, 65) that the proteose and proteose-like body discovered in saline extracts of wheat flour by Osborne and Voorhees is gliadin. The author repeats the statement of the original article (*ibid.*, 15, 404) that the proteids of the extract were separated from the gliadin by ammonium sulphate solution, in which this body is insoluble. He believes that the proteose which was found in this salt solution cannot be gliadin.

Proximate Analysis of Orris Root. By S. Allen Tucker. *Am. J. Pharm.*, 69, 199-200.—The author gives the results of his experiments upon the granular substance, which was ground fine and extracted with petroleum ether, ethyl ether, alcohol, water, etc. His results for moisture and ash determinations, as well as of the qualitative analysis of the ash, are also given. Unfortunately, as no descriptions and details of the processes he employed accompany the article, the numerical values must be accepted with caution.

Parthenium Hysterophorous. By H. V. Arny. *Am. J. Pharm.*, 69, 169-180.—This is a continuation of work done by the author on this "common weed of Jamaica." Following a description of the plant, its blossoms, etc., the author states that besides starch, wax, gum, and mineral salts, there is also present an active principle to which the bitterness of the plant is due. This is obtained from the alcoholic extract of the drug by evaporation, solution in water, and extraction with chloroform. An improved process of extraction is also given. A well crystallized body was obtained, and its melting-point found to be 168–169° C. Its solubility in various reagents is given. The author is led to reject the belief that the body is either an alkaloid or glucoside, but considers it probably similar to santoni.

The Rotary Properties of Some Vegetable Proteids. By Arthur C. Alexander. *J. Expt. Medicine*, 1, 304-323.—The author has determined the specific rotary powers of the globulins of hempseed, flaxseed, and Brazil nuts, in aqueous solutions of salts, acids, and alkalies. The specific rotary powers differed with different salt solutions, decreased in general with the percentage of the proteid in solution, and changed but slightly with the temperature.

Changes in and Additions to Methods of Analyses Adopted at the 13th Annual Meeting of the Association of Official Agricultural Chemists. By H. W. Wiley. *U. S. Dept. Agr. Circular No. 2*, 1-6.—This pamphlet is a supplement to the official methods of Bulletin No. 46, consisting of corrections and substitutions to be interlineated into that report. The methods for analysis of fertilizers, soils, foods, and feeding-stuffs, tanning materials, and fermented liquors have all been improved. These corrections are many of them very important.

E. H. RICHARDS, REVIEWER.

California Walnuts, Almonds, and Chestnuts; their Composition and Draft upon the Soil. By E. W. Hilgard. *Cal. Expt. Sta. Bull.*, 113, 1-15.—Nuts are a concentrated form of food. The walnut and almond kernels contain respectively 65 and 58 per cent. of oil, and 17 and 25 per cent. of proteids, while the chestnut yields about 11 per cent. of oil and of proteid, and 75 per cent. of carbohydrates, or nearly as much as prunes and apricots. The chestnut may, therefore, take the place of cereals, and the walnut and almond that of meats, under certain conditions.

Chemical Survey of the Water Supplies of Illinois. By A. W. Palmer. *Preliminary Rep., published by the Univ. of Ill.*, 1-98.—This report is a valuable addition to our knowledge of the character of water supplies of the United States, and will well repay close study. "The aims of the survey include the determination of the present sanitary condition of the supplies drawn from the lakes, the streams, and the wells of the State; the determination of the normal condition of the contaminated waters; the formulation of local standards of purity based upon the results of analyses of water derived from unpolluted sources; the provision of such means as shall afford to citizens of the State opportunity to obtain immediate information regarding the wholesomeness of the potable waters in which they are directly interested; and the prevention and dissemination of disease from the use of impure water." Although the conditions of work in a State university demand the analysis of miscellaneous samples, collected under unknown conditions by untrained persons, and consequently render the results obtained from this class of water somewhat uncertain, the information given by the figures tabulated for 802 samples of such water is most interesting to all who have to do with the sanitary conditions of the Middle West. Of far more interest to the chemical and sanitary engineer are the results of the periodic examinations of wells in various parts of the State for the purpose of determining the character of the normal ground water of the State. The importance of this part of the work is evident from the statement that more than half the inhabitants of the State depend upon wells for their water supply. A comparison of the figures tabulated for the comparatively shallow wells shows a greater proportion of nitrates to chlorine than is usual in the waters of the East. Even in the deep drift wells the nitrates vary very much more than the chlorine. This is possibly due to the passage of the water through the rich prairie soil, presumably higher in nitrates than the poorer soils of the East, or to a lessened use of salt in the ordinary household operations. It would seem rather premature to establish standards before determining some of the causes of the unusual variations observed even in the best waters. The periodic analyses of the several surface waters are of great interest for reference and comparison. The plans of work and the methods of analysis used are, for the most part, taken from those published in the reports of the Mass. State Board of Health.

Dietary Studies at the Maine State College in 1895. By WHITMAN S. JORDAN. *U. S. Agr. Expt. Sta. Bull.*, 37, 1-57. —This Bulletin contains the records of a large number of analyses of food materials and gives other data for the calculation of dietaries. The conclusions in regard to the use of milk in place of meat are somewhat influenced by the fact that a new manager, during the first weeks of service, would naturally use more meat than in the later time when he had gained experience. Milk may be a cheap food when the whole ration is a somewhat expensive one, when the milk can be bought at the low price of 4 cents per quart, and when the meat used costs 10 to 20 cents per pound; but when the daily expense must be limited to an outlay of 9 to 15 cents and milk costs 5 to 6 cents per quart, while beef may be had at 6 cents per pound, the conclusion does not hold. More data are needed before we can accept, as settled, the statement that the free use of milk lessens the use of other foods.

Sand Filtration of a Public Water Supply. By JAMES O. HANDY. *Proc. Eng. Soc. Western Pa.*, *1897*, 1-57.—The records of a year's working of an experimental filter used in connection with the city water supply of Pittsburg, Pa., are given in detail, together with a considerable number of chemical and bacteriological results.

Brief Comments on the Materia Medica, Pharmacy, and Therapeutics of the Year Ending October 1, 1896. BY E. H. SQUIBB. *Squibb's Ephemeris*, 4, 1776–1923.

AGRICULTURAL CHEMISTRY.

F. H. THORP, REVIEWER.

Analyses of Fertilizers. *Agr. Ex. Sta. Bull. Ky. No.* 65; *Me. No.* 33; *Md. No.* 45; *Mo. No.* 34; *N. J. No.* 117; *Vt. No.* 57; *Wis. No.* 57.

Basic Slag as a Fertilizer. BY F. E. THOMPSON. *Scientific Am. Supp'l.*, 43, 17659.—The author gives a resumé of the published reports of the various State Agricultural Experiment Stations of the United States on the use of basic slag as fertilizer.

Effect of Bisulphide of Carbon on the Vitality of Seeds and Plants. BY M. H. BECKWITH. *Del. Agr. Exp. Sta. Rep., 1895*, 152.—The germination of wheat treated with carbon bisulphide before planting, was not affected to any extent. Strawberry plants were injured by exposure to the fumes before planting, but when growing no injury was noticed.

The Bleaching of Nuts by Dipping. BY E. W. HILGARD. *Cal. Agr. Col. Bul. No. 113.*—This paper gives an account of the use of sodium hypochlorite and bisulphite solutions, for bleaching the shells of nuts.

Ammoniacal Solutions of Copper Carbonate. BY C. L. PENNY. *Del. Agr. Sta. Rep., 1895*, 206.—The author finds that dilute ammonia will dissolve more copper carbonate than stronger solutions. For the preparation of fungicides, the ammonia should be diluted nine-fold before dissolving copper carbonate in it, and this solution is further diluted one hundred-fold before use.

G. W. ROLFE, REVIEWER.

The Insoluble Carbohydrates of Wheat. BY H. C. SHERMAN. *J. Am. Chem. Soc.*, 19, 291–316.—This is an important paper giving in much detail the preparation of many of these carbohydrates, their characteristic reactions, and the more approved methods for their determination. A brief review is given of the work done to solve the much discussed question of the food value of the celluloses and pentosans.

E. H. RICHARDS, REVIEWER.

Sorghum as a Forage Crop. BY THOMAS A. WILLIAMS. *U.S.*

Dept. Agr. Farmers Bull., 50, 1–20.—Beside the discussion relating to the cultivation of sorghum, there are given tables showing the results of chemical analyses of the plant and seeds, and a comparison with analyses of corn.

APPARATUS.

A. H. GILL, REVIEWER.

Note upon an Improved Specific Gravity Bottle. BY E. R. SQUIBB. *Squibb's Ephemeris*, 4, 1771–1775.—The usual form of bottle with the neck ground in, is modified by graduating and calibrating this neck, so that the bottle may be used for temperatures from 0° to 25°.

Some Apparatus for the Technical Laboratory. BY E. S. JOHNSON. *J. Am. Chem. Soc.*, 19, 281.—The article describes apparatus for the measuring of reagents, filtration, and solution with the aid of heat. For details reference must be made to the illustrations in the original paper.

A New Calibrated Weighing Flask. BY G. L. HEATH. *J. Am. Chem. Soc.*, 19, 198.—The improvement consists of a collar ground upon the ordinary flask and a cap to fit it. This flask has the advantage that it can be stoppered without danger of sticking.

The Use of Aluminum for Condensers. BY T. H. NORTON. *J. Am. Chem. Soc.*, 19, 153.—It was found that aluminum possesses the same advantages over glass as tin, but is much lighter and a better conductor of heat; hence it is better adopted for use with low boiling substances.

A New Laboratory Grinder. BY C. A. BUCK. *J. Frank. Inst.*, *1897*, 194.—It has been in use in the laboratory of the Bethlehem Iron Co. for five hours a day for three years and given satisfaction. It will grind a charge of 30 grams of refractory magnetite from 80 mesh to an impalpable powder in fifteen minutes.

METALLURGICAL CHEMISTRY.

H. O. HOFMAN, REVIEWER.

The Smelting of Zinc-Lead Sulphides. BY L. KLOZ. *Eng. Min. J.*, 63, 358.—In smelting zinc-bearing lead ores the zinc is carried off by the gases, the slag, and the matte, little of it entering the lead. The zinc carried off by the gases forms wall accretions to some extent which interrupt the descent of the charges; zinc oxide or silicate being difficult of fusion makes the slag less fusible and causes particles of matte to remain suspended in it, thus enriching it. In the large Rhodes' reverberatory furnace of Leadville, Colo., matte and slag tapped from the blast-furnace are given time to separate. In this way waste slag with one per cent. lead and 0.5 ounce silver per ton is obtained from slags running as high as six per cent. lead and 10 ounces silver.

The Distribution of the Precious Metals and Impurities in Copper, and Suggestions for a Rational Mode of Sampling. BY E. KELLER. *J. Am. Chem. Soc.*, **19**, 243–258.—This paper is the first systematic investigation of the subject that has appeared in print. Experience teaches that precious metals and impurities are unevenly distributed in metallic copper. A careful investigation of blast-furnace, reverberatory-furnace, and converter coppers of different degrees of purity, shows that there is little regularity in the uneven distribution. In some cases the foreign elements concentrate toward the center of solidification (which lies above the geometrical center, as the metallic mold draws off more heat from the bottom than the air at the top), in others they concentrate toward the outside. Hence, ordinary methods of sampling bars or pigs give unsatisfactory results. What is required is a form of sample bar in which the distribution shall be even, and in pouring the ladle must be hot enough to prevent any sculling, as the liquid part is sure to show a different percentage of precious metal from that which solidifies on the ladle. A sample bar (or plate), the thickness of which is small in comparison with the length and width, has the desired form, as the concentration from side to center cannot go farther than a distance equal to the thickness of the plate, because at that moment the entire plate has solidified. The border of the plate for a distance equal to the thickness of it will show an irregular distribution, within the border, concentration having taken place in one direction only; a correct sample will result, if the plate be punched or drilled through. The tests were made on plates 15 inches square and one inch thick. In trying to give an explanation of the irregular distribution of impurities, the author first ascertained by experiment that a charge of molten copper remained uniform in composition, when it had once been made so by thorough agitation and mixing. The different elements show different degrees of concentration. This, in a general way, excepting sulphur, corresponds with their melting-points, the more readily fusible the metal, the greater is the unevenness of distribution. Atomic weight and specific gravity do not appear individually to have any bearing upon the subject, but if the concentration is compared with the atomic volumes of the elements, there appears to be a correspondence, the concentration being the largest, where the difference in atomic volume is greatest.

Phosphor Bronze. By M. H. Wickhorst. *Foundry*, 10, 53–57; *Iron Age*, 59, No. 12, 2–3.—This paper, read before the Western Foundrymen's Association, treats, in a general way, of bronzes, their properties and manufacture. Of special interest is a bronze with six per cent. phosphorus made by the Chicago, Burlington, and Quincy Railroad Company's brass foundry at Aurora, Ill., in order to have phosphorus in convenient form for the preparation of phosphor bronze. The method of its manufacture is described in detail.

A New Process for Separating Nickel and Copper. By R. P. Rothwell. *Eng. Min. J.*, 63, 328.—N. V. Hybinette and A. R. Ledoux have tested, on a large scale, at the Balbach works, Newark, N. J., a new process for separating nickel and copper sulphides. It consists in smelting nickel-copper matte with oxide of manganese and cooling, when the mixture will separate into two parts, the "top" containing most of the copper and manganese sulphide, the "bottom" most of the nickel sulphide. By repeating the operation the separation becomes perfect. The manganese can be used over again (how is not stated) or a manganese bronze made of the top.

Practical Treatment of Pyritic Gold Ores at Gibbonsville, Mont. By C. C. Burger. *Min. Sci. Press*, 74, 282–285.—This is a detailed description of the process in use, *viz.*: (1) Amalgamation in the battery and saving of concentrates; (2) roasting in twenty-four hours from 12 to 15 tons of concentrates with from 33 to 40 per cent. sulphur, in a two-hearth Pearce turret furnace, supplemented by a small hand reverberatory furnace holding two 1½-ton charges, to insure dead-roasting without diminishing the capacity of the mechanical furnace; (3) Chlorinating in a 1½-ton Thies barrel; (4) Filtering with compressed air in steel lead-lined cylinders swung on trunnions; (5) Settling any slimes that passed the filter cloth; (6) Precipitating with ferrous sulphate. The cost of chlorinating is less than $5 per ton. The ore is low-grade ($10 per ton), the gangue consists of quartz and magnesian slate, the concentrates are mainly pyrite, contain some arsenopyrite, and show from 0.5 to 1 per cent. copper.

[CONTRIBUTION FROM THE MASSACHUSETTS INSTITUTE OF TECHNOLOGY.]

REVIEW OF AMERICAN CHEMICAL RESEARCH.

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ARTHUR A. NOYES, Editor; HENRY P. TALBOT, Associate Editor.

REVIEWERS: Analytical Chemistry, H. P. Talbot and W. H. Walker; Biological Chemistry, W. R. Whitney; Carbohydrates, G. W. Rolfe; General Chemistry, A. A. Noyes; Geological and Mineralogical Chemistry, W. O. Crosby; Inorganic Chemistry, Henry Fay; Metallurgical Chemistry and Assaying, H. O. Hofman; Organic Chemistry, J. F. Norris; Physical Chemistry, H. M. Goodwin; Sanitary Chemistry, E. H. Richards; Technical Chemistry, A. H. Gill and F. H. Thorp.

METALLURGICAL CHEMISTRY.

H. O. HOFMAN, REVIEWER.

Applications of the Cyanide Process in South Africa. BY C. BUTTERS. *Eng. Min. J.*, 63, 233–234.—This is a lecture delivered before the Chemistry Section of the Science Association of the University of California, Berkeley. Cal. It contains an account of the development of the process in South Africa, and gives the details of the present practice, which are of much interest to the metallurgist.

Sodium Dioxide in Cyaniding Ores. BY J. H. BURFEIND. *Eng. Min. J.*, 63, 399–400.—The author does not accept the statement that in cyaniding ores containing alkali earth sulphates, the extraction of precious metal is increased, and the consumption of cyanide diminished, by the use of sodium dioxide. He believes that alkali earth sulphates are in part converted into cyanides, which are solvents for gold, and an equivalent amount of potash into sulphate. Taking, *e. g.*, an ore with gypsum, some of it will be converted into calcium cyanide. In dissolving gold, the double cyanide of gold and calcium will be formed in addition to the double cyanide of potassium and gold. If such a solution is treated with zinc shavings, the products will be gold, calcium and potassium hydroxides, zinc cyanide, and hydrogen; potassium hydroxide and zinc cyanide will combine to a soluble double salt, while from the calcium hydroxide there will be precipitated calcium carbonate by potassium carbonate in the solution and by carbonic acid taken up from the air. This explains the fact that the precipitated gold is often rich in calcium carbonate. While the formation of calcium carbonate can be avoided by the use of sodium dioxide, it is practically non-available on account of its cost, and the removal of calcium carbonate from the gold precipitate is easy and costs next to nothing.

Separation of Gold and Silver from Low-Grade Bullion. By F. Gutzkow. *Eng. Min. J.*, 63, 380–381.—The sulphuric acid process being suited only for high-grade doré silver, millmen ship their low-grade bullion, of say 500 thousandths fineness, to lead refineries where the copper is removed by cupelling with lead. This involves a great expense to the millman who pays for transportation of the copper in his bullion east, and of the blue vitriol west, in addition to a high refining charge based on the gross ounce of bullion. The process in question aims to separate silver, gold, and copper at the mill, producing fine silver, gold of greater or less purity, and blue vitriol. In the process the low-grade alloy is dissolved in a cast-iron vessel in sulphuric acid that is lighter than 66° Beaumé. When dissolved, heating is continued until the water is drawn off and the solution becomes so concentrated that anhydrous cupric sulphate is formed and separates. Now the clear silver solution is siphoned off, diluted and cooled, when silver sulphate crystallizes out and is treated in the usual way, while the mother-liquor of about 62° Beaumé is strengthened with fresh acid, and is ready to be used for a new charge. The gold and copper sulphates remaining with some silver sulphate and impurities in the iron vessel, are removed to a pan and boiled in water in the presence of some metallic copper, when the cupric sulphate will be hydrated and dissolved, and the silver sulphate decomposed. The blue vitriol solution is concentrated and crystallized, and the gold, contaminated with some silver and insoluble impurities, treated by one of the usual methods.

Chemical Hints to Foundrymen. By G. R. Johnson. *Foundry*, 10, 71–73; *Iron Age*, 59, No. 10, 5–8.—The paper is a study of the effect of carbon, silicon, sulphur, phosphorus, and manganese upon foundry iron. Many analyses of pig irons from the Embreville Iron Co., Embreville, Tenn., are brought together in tables, and the relations of chemical composition and physical properties shown.

The Bertrand-Thiel Open Hearth Process. By J. Hartshorne. *Iron Age*, 59, No. 12, 2-4.—This article contains a discussion of a paper read by P. C. Gilchrist, before the Cleveland (England) Institute of Engineers.

W. H. WALKER, REVIEWER.

An Alloy Composed of Two-thirds Aluminum and One-third Zinc. By W. F. Durand. *Science*, 5, 396.—Of the alloys of zinc and aluminum, one having the above proportions gives the best results, showing itself equal to good cast iron in strength, and superior in many other qualities. It melts at about 800° F., does not readily oxidize, takes a fine finish, and perfectly fills the smallest parts of a mould. Like cast iron, it is brittle, but it is recommended when lightness and strength, combined with good finish and resistance to corrosion, are among the desiderata.

INORGANIC CHEMISTRY.

HENRY FAY, REVIEWER.

On Hydrocobaltocobalticyanic Acid and Its Salts. BY C. LORING JACKSON AND A. M. COMEY. *Am. Chem. J.*, 19, 271–281.—With the hope of preparing from potassium cobalticyanide compounds analogous to the nitroprussides, a strong solution of potassium cobalticyanide was boiled with strong nitric acid. In less than five minutes the liquid turned red, and the color increased in intensity as the boiling was continued. After boiling about two hours the red solution was converted into a semi-solid gelatinous mass. This product was purified by heating with more nitric acid and washing with water, but as the impurities were removed it began to pass into solution. Essentially all of the cobalt remained in the precipitate, and in the filtrate there was found nitric and hydrocyanic acids, and potassium nitrate. The insoluble jelly was dried *in vacuo* for analysis, when it changed in color from red to a grayish green, but was very hygroscopic, absorbing water readily, at the same time regaining its red color. The solubility seems to vary with the preparation. It usually dissolves slowly, and to a limited extent in cold water, but digestion at 60° C. brings it completely into solution. The composition corresponds to the formula $KH_2Co_2(CN)_{11}.H_2O$. The solution is strongly acid and gives colored precipitates with metallic salts. By mixing a solution of the salt with potassium acetate and alcohol, there is thrown down a pink, flocculent precipitate, which is the dipotassium cobaltocobalticyanide, $K_2HCo_2(CN)_{11}.2H_2O$. Barium cobaltocobalticyanide, $BaHCo_2(CN)_{11}1\frac{1}{2}H_2O$, retains its water of crystallization at 180°C., and is decomposed at 225° C. The silver salt, $Ag_2Co_2(CN)_{11}.H_2O$, is made by adding an excess of silver nitrate to the solution of the monopotassium salt. The zinc salt, $ZnHCo_2(CN)_{11}.3H_2O$, and copper salt, $Cu_3[Co_2(CN)_{11}]_2.4H_2O$, are also described. Free hydrocobaltocobalticyanic acid was obtained by treating hydrocobalticyanic acid with nitric acid, precisely as was done with the potassium cobalticyanide in making the monopotassium salt, which it closely resembles, except that it is less stable and gives off hydrocyanic acid when dried. When potassium hydroxide was added to the solution of the monopotassium salt, it turned dark brown in the cold, and when the liquid was warmed the color deepened to a black, but nothing was precipitated until the solution was boiled. A precipitate of cobaltic hydrate was then formed, but the separation was slow and gradual. If the solution is filtered before precipitation is complete, the yellowish filtrate gives a further precipitate of cobaltic hydroxide on boiling again. Acetic acid added to this solution does not set free hydrocyanic acid. If, after the acetic acid, alcohol be added, it throws out fine white needles, which, on analysis, are shown to be identical with potassium cobalticyanide, but of entirely different crystal habit. A secondary oily product was formed in this reaction, which, on drying, was converted into a yellow solid, the nature of which has not been established. There is a general analogy between these substances and Prussian blue, but they differ essentially, in that in the cobalt compounds all of the cobalt is in the basic portion of the salt.

On the Analogies in Composition of the Salts of Calcium, Strontium, and Barium. By J. H. Kastle. *Am. Chem. J.*, **19**, 281–290.—The author has found that of 280 acids described in chemical literature, 252 show analogies in the composition of their calcium, strontium, and barium salts. Of these acids, the calcium, strontium, and barium salts of 141 have been described. From this number, 34 salts are entirely analogous for the three elements, and 79 show analogies between two of the salts. Of the latter, the analogy existing between the calcium and strontium salts is shown in 30 instances, between the calcium and barium salts in 25, and between the strontium and barium salts in 30 cases. In addition, 139 acids have been found, of which the salt of only two of these metals have been described, but all are stated to be analogous. From these observations the author comes to the general conclusion that *of the calcium, strontium, and barium salts of any acid, all or two of the salts of these metals will be found to be analogous in composition.* This is in opposition to the statement of Lenssen, that there is closer relationship between the strontium and barium than the calcium salts.

On the Action of Ammonia upon Cupriammonium Acetobromide. By Theodore William Richards and Robert Jay Forsythe. *Proc. Am. Acad. Arts and Sci.*, **32**, 239–241.—By passing ammonia gas over cupriammonium acetobromide in a glass tube, placed in a freezing mixture, the substance takes up ammonia corresponding in amount to $3NH_3$. The new substance, $CuBrC_2H_3O_2.5NH_3$, dissolves in water to a deep blue solution, and loses ammonia on exposure to the air passing over into a green compound, $CuBr_2.6NH_3$. This change of color is taken as proof that the ammonia decomposed the original cupriammonium acetobromide, and the decomposition of the addition product may be represented in this way:

$$2Cu(NH_3)_2Br.C_2H_3O_2.3NH_3=CuBr_2.6NH_3+Cu(C_2H_3O_2)_2.4NH_3$$

The first of these compounds was already known, and the second was synthesized by passing ammonia over cupriammonium acetate. The analytical data are not exact, owing both to the ease with which the substances lose ammonia, and to their great hygroscopic power.

On Certain Double Halogen Salts of Caesium and Rubidium. BY H. L. WELLS AND H. W. FOOTE. *Am. J. Sci.*, 153, 461–465.—The authors have repeated the work of Remsen and Saunders and Remsen and Brigham, to see whether, by working under widely varying conditions, they could obtain several simpler salts by recrystallizing the complex rubidium antimony chloride, $23RbCl.10SbCl_3$. No variation of composition was detected, although the salt was crystallized from dilute, concentrated and alcoholic hydrochloric acid. The analytical process used in the determination of antimony was checked against the pure salt, $Cs_3Sb_2Cl_9$, containing nearly the same percentage of antimony. The method gave results about 0.25 per cent. too high, and the authors believe that by subtracting this constant error from the amount of antimony found in the analyses of the rubidium salt, it will give results nearer the truth. The results thus obtained agree more closely with the simpler formula, $7RbCl.3SbCl_3$, and this formula is proposed for this salt as well as for the other salts of analogous composition, described by Remsen and Brigham, Herty, and Wheeler. While there is much to be said in favor of the simple formula, it would seem advisable to offer evidence as to the accuracy of the determination of rubidium and chlorine in the salts as well as antimony. In recrystallizing this complex rubidium antimony chloride from very dilute hydrochloric acid, just enough to prevent the precipitation of antimony oxychloride, a new salt having the composition $2RbCl.SbCl_3.SbOCl$ was formed. It crystallizes in sharp, colorless prisms, and can be recrystallized from dilute hydrochloric acid. The work of Remsen and Brigham on the caesium bismuth chlorides was confirmed, and the new salt, $3CsI.2BiI_3$, described. For analysis this salt was dissolved in dilute hydrochloric acid, the bismuth precipitated as sulphide, digested with nitric acid until decomposed, the free sulphur removed by filtration, and the bismuth reprecipitated as carbonate. The caesium was determined as sulphate.

On the Double Fluorides of Zirconium with Lithium, Sodium, and Thallium. BY H. L. WELLS AND H. W. FOOTE. *Am. J. Sci.*, 153, 466–471.—It has been found by a comparison of the double fluorides of zirconium with ammonia, potassium, and caesium, that the types of double salts formed varied with the molecular weights of the alkaline fluorides. A relatively large number of molecules of small molecular weight enter into combination, while those fluorides of higher molecular weight combine with more zirconium fluoride than the others. This was found to be true also in double fluorides of zirconium and lithium. Salts of the 4 : 1 and 2 : 1 type were prepared, but the 3 : 1 type could not be made. The following table shows the symmetrical gradation of types, according to the atomic weight of the alkali metals :

Type.	Lithium salts.	Potassium salt. (Mariguac.)	Caesium salts.
4 : 1	$4LiF.ZrF_4.\frac{2}{3}H_2O$	......	......
3 : 1	......	$3KF.ZrF_4$	......
2 : 1	$2LiF.ZrF_4$	$2KF.ZrF_4$	$2CsF.ZrF_4$
1 : 1	......	$KF.ZrF_4$	$CsF.ZrF_4.H_2O$
2 : 3	......	......	$2CsF.3ZrF_4.2H_2O$

The double fluorides of sodium and thallium with zirconium fluoride do not form a symmetrical series which will fall into line with the known other salts. The salt $2NaF.ZrF_4$ was prepared by bringing together two parts sodium fluoride with fourteen parts zirconium fluoride. The following double fluorides of thallium and zirconium were prepared: $TlF.ZrF_4.H_2O$, $5TlF.3ZrF_4.H_2O$, and $3TlF.ZrF_4$. The first salt separates without water of crystallization if the solution is evaporated until crystals begin to form, and then cooled. Two of these thallous salts correspond to recognized types of alkali salts, while the 5 : 3 type is new.

The Oxides of Tungsten. By En. D. Desi. *J. Am. Chem. Soc.*, 19, 213–241.—By treating tungstic acid or metallic tungsten with sulphuric and sulphurous acids at various temperatures, under atmospheric pressure and in sealed tubes, oxides of tungsten were isolated corresponding to the formulas WO, W_4O_3, W_2O_3, W_5O_{12}, W_5O_9, W_5O_{14}. By heating ammonium tungstate to a white heat the oxide, W_3O_8 was formed, and it was also obtained by fusing tungstic acid with potassium iodide. Upon fusing tungstic acid with potassium chloride, potassium bromide, metallic sodium or potassium, metallic tungsten was formed. Different oxynitrides of tungsten were prepared by acting upon tungstic acid with ammonium chloride, potassium cyanide, and cyanogen. Tungstic acid can be separated from molybdic acid by dissolving the latter in sulphuric acid, while the former is entirely insoluble.

Recovery of Waste Platinum Chloride.—By H. W. Wiley. *J. Am. Chem. Soc.*, 19, 258–261.—Aluminum turnings are suggested for the reduction of potassium platinochloride to metallic platinum.

Compounds of Metallic Hydroxides with Iodine. By Theodore Rettie. *J. Am. Chem. Soc.*, **19**, 333–339.—The author has examined the brown precipitate formed when magnesium sulphate is treated with iodine and potassium hydroxide, and finds that it is not of constant composition, being principally magnesium hydroxide with a variable quantity of iodine. Colored precipitates are formed with zinc and cadmium salts. Glucinum sulphate, and calcium and strontium salts, give precipitates which dissolve on standing.

Variations in the Composition of Red Lead. By Durand Woodman. *J. Am. Chem. Soc.*, **19**, 339–341.—If commercial red lead is treated with a saturated solution of lead acetate the lead monoxide is dissolved, leaving the true red lead. The percentage of Pb_3O_4 found in this way varies from 41 to 92 per cent.

ORGANIC CHEMISTRY.

J. F. Norris, Reviewer.

On the Colored Compounds Obtained from Sodic Ethylate and Certain Aromatic Nitro Compounds. By C. Loring Jackson and Martin H. Ittner. *Am. Chem. J.*, **19**, 199–217.—By the action of sodium ethylate on fourteen compounds of the general structure CH_3(or COOH)(1)NO_2(3)X(4)NO_2(5) colored bodies analogous to those obtained by Victor Meyer (*Ber.*, **27**, 3153) and Lobry de Bruyn (*Rec. Trav. Chim. Pays. Bas.*, **14**, 89) from *s*-dinitrobenzoic acid and *s*-trinitrobenzene have been prepared. The colors formed from the toluene derivatives lasted but a few seconds, while those from the benzoic acids were stable for several hours. The colored compound from dinitranisic acid was isolated by precipitation from an alcoholic solution with ligroïn and, after drying *in vacuo*, had the composition $C_6H_2.OCH_3.(NO_2)_2.COONa.C_2H_5ONa$. When heated at 110° it was decomposed and lost a weight nearly corresponding to one molecule of alcohol. The authors offer no structural formulæ for the compounds, but show that the explanation of Victor Meyer, that they are formed by the replacement of one atom of hydrogen in the benzene ring by an atom of sodium, and the addition of a molecule of alcohol of crystallization is rendered improbable by the work of Lobry de Bruyn. The latter proved that *s*-trinitrobenzene is not acted on by sodium in boiling xylene and that its colored derivative has the composition $C_6H_3(NO_2)_3.CH_3OK.\frac{1}{2}H_2O$, in which, if Meyer's explanation is correct, there are both alcohol and water of crystallization. This latter assumption is highly improbable.

On the Action of Chlorcarbonic Ethyl Ester on Formanilide. BY H. L. WHEELER AND H. F. METCALF. *Am. Chem. J.*, 19, 217–227.—The authors have studied the action of chlorcarbonic ethyl ester on formanilide, and find that the explanations of the reaction given by Lellmann (*Ber.*, 14, 2512), and Freer and Sherman (*Am. Chem. J.*, 18, 579), are in part incorrect. The following substances were obtained as final reaction-products: Diphenylformamidine hydrochloride, formylphenylurethane, phenylurethane, carbon dioxide, carbon monoxide, and ethyl chloride. The reaction can be explained whether formanilide is, as its name implies, an anilide with the structure $HCO.NHC_6H_5$, or whether it has the imido structure and is phenylimidoformic acid. Its structure cannot, therefore, be determined by the final reaction-products. The oil obtained by Freer and Sherman (*loc. cit.*), and which they state is ethylisoformanilide, proved to be a mixture of formphenylurethane, phenylurethane, and unaltered formanilide. It is also shown that Claisen's argument (*Ann. Chem.* (*Liebig*), 287, 360) for the amide structure of formanilide, based on the relation of its boiling-point and that of its oxygen ester, is not well taken. Formylphenylurethane, $C_6H_5N.CHO.CO_2C_2H_5$, was prepared by the action of chlorcarbonic ethyl ester on ethylisoformanilide. It boils from 149° to 151° at 15 mm. pressure. The above structure was shown to be correct by the action of alkali and of phenyl hydrazine. With the former there was a separation of the lower acid, giving phenylurethane; with the latter, α-formphenylhydrazine was formed.

Naphthalene Tetrabromide, $C_{10}H_8Br_4$. BY W. R. ORNDORFF AND C. B. MOYER. *Am. Chem. J.*, 19, 262–270.—But one of the three possible stereochemical modifications of naphthalene tetrabromide was formed by the action of naphthalene on bromine. This was made by cautiously treating naphthalene covered with an ice-cold four per cent. solution of sodium hydroxide with bromine, and allowing the mixture to stand in the cold for several hours. Of the pure product, which melted at 111°, with decomposition after crystallization from chloroform, 7 grams were obtained from 100 grams of naphthalene. A large quantity of α-monobromnaphthalene and 1 : 4 dibromnaphthalene were obtained at the same time. The tetrabromide is insoluble in water, ether, glacial acetic acid, and cold alcohol; soluble in hot water, carbon bisulphide, ligroïn, hot chloroform, and hot benzene. It crystallizes in transparent monoclinic prisms, which become opaque on standing. A full crystallographic study of the compound is given. As the tetrabromide decomposed in all boiling solvents, its molecular weight could not be determined. A determination of the molecular weight of the analogous chloride gave results corresponding to the formula $C_{10}H_8Cl_4$.

Action of Mercaptides on Quinones. By H. S. Grindley and J. L. Sammis. *Am. Chem. J.*, 19, 290–295.—By the action of sodium mercaptide on dichlordiphenoxyquinone, a compound was obtained analogous to the hemiacetals prepared by Jackson and Grindley (*Am. Chem. J.*, 17, 577) from quinones and sodium alcoholates. The yellow sodium salt formed when six molecules of the mercaptide and one of the quinone were used was so unstable that it could not be analyzed. It decomposed readily in the presence of water forming tetrathioethylquinone, $C_6(SC_2H_5)_4O_2$, which melts at 90°–91°, and gives a hydroquinone melting at 58°. The tetrathioethylquinone, when treated with two equivalents of sodium mercaptide, gives the unstable yellow salt which, in turn, gives the compound tetrathioethylquinone dibenzoyl-dithiobenzoylacetal $C_6(S.C_2H_5)_4(O.CO.C_6H_5)_2(S.CO.C_6H_5)_2$ when treated with benzoyl chloride in alcoholic solution. The substance is not affected by either zinc dust and glacial acetic acid or hydroxylamine hydrochloride.

The Hydrolysis of Acid Amides. By Ira Remsen. *Am. Chem. J.*, 19, 319–322.—In a preliminary note which announces that the author has undertaken an extensive investigation of the speed of hydrolysis of the acid amides, the rate of decomposition of the three nitrobenzamides with half normal hydrochloric acid is reported. At the end of 3 hours 3.3 per cent. of the *o*-amide, 80.5 per cent. of the *m*-amide, and 84.5 per cent. of the *p*-amide were hydrolyzed. At the end of 6 hours 6.2 per cent., 94.2 per cent., and 96.9 per cent. of the ortho, meta, and para amides, respectively, were changed.

On Urethanes. By Otto Folin. *Am. Chem. J.*, 19, 323–352.—From the study of the action of sodium methylate on a number of acid bromamides the author deduces the following conclusion: The reaction

$$RCONHBr + NaOCH_3 = RNHCOOCH_3 + NaBr,$$

is quite as general as the analogous reaction of alkalies on acid bromamides, and should be as useful in the preparation of urethanes, as is the reaction of Hofmann for the amines. The introduction of negative groups into the radical R does not prevent the "Beckmann rearrangement," and in no case was direct substitution of the bromine effected even to a slight extent. The introduction of a positive group in one case had no more influence than that of a negative group. The following compounds were prepared from the corresponding bromamides and are described in detail: Methylphenyl carbamate; methyl-*m*-nitrophenyl carbamate, crystallizing in well-formed octahedra which melt at 147°–149°; methyl-*o*-nitrophenyl carbamate, greenish-yellow crystals, which melt at 53°; methyl-*m*-bromphenyl carbamate, white crystals melting at 84.5°–85.5°. The yield in all cases was nearly quantitative. As it was found impossible to obtain an acid bromamide containing the amido or dialkylamido group in the benzene ring, an analogous amide in the aliphatic series was prepared, carbomethoxy-β-amidopropionbromamide, $CH_3O_2CNHCH_2CH_2CONHBr$, from which the corresponding urethane was formed by the action of sodium methylate. The study of the action of phosphorus pentachloride on a number of aromatic urethanes leads to the following equation, which is general.

$$RNHCO_2CH_3 + PCl_5 = RNHCOCl + CH_3Cl + POCl_3.$$

This reaction and the one given above furnish easy methods for the preparation of chlorformanilides and isocyanates. With free urethane phosphorus pentachloride splits off ethyl chloride and a carbamide chloride is formed, but the reaction is not so simple as with the aromatic urethanes. A simple method of preparation of urethane from potassium cyanate and alcohol is described. Phosgene and urethane, when brought together in molecular proportions, reacted simultaneously in the different ways:

1. $NH_2CO_2C_2H_5 + COCl_2 = ClCONHCO_2C_2H_5 + HCl.$
2. $ClCONHCO_2C_2H_5 + NH_2CO_2C_2H_5 = CO(NHCO_2C_2H_5)_2 + HCl.$
3. $2NH_2CO_2C_2H_5 + COCl_2 = NH_2CONHCO_2C_2H_5 + C_2H_5Cl + CO_2 + HCl.$

The products of the reaction are fully described.

Action of Phosphorus Pentachloride on Aniline and its Salts. By J. Elliott Gilpin. *Am. Chem. J.*, **19**, 352–363.—Trichlorphosphanil, $PCl_3(NC_6H_5)$, was obtained by subliming phosphorus pentachloride and aniline hydrochloride at 170° for six hours. The compound condensed in the cooler part of the vessel as a white coating. It cannot be purified by crystallization, as all solvents decompose it. Concentrated sulphuric acid, alcohol, and ether, cause an evolution of hydrochloric acid; sodium hydroxide changes it to a hard, brittle mass; and water decomposes it into aniline hydrochloride and phosphoric acid. Neither the sulphate nor the nitrate of aniline gave the compound when heated with phosphorus pentachloride. Aniline and phosphorus pentachloride react readily with evolution of hydrochloric acid. The cooled mass is extracted with water, then with small portions of hot alcohol, until, on evaporation, one kind of crystals is obtained, and finally crystallized from boiling alcohol. The resulting compound, chlorphostetranilide, $PCl(NHC_6H_5)_4$, is very stable. It is not decomposed when boiled with water, concentrated alkali, or hydrochloric acid; but when heated with water in a sealed tube at 180°, aniline, aniline hydrochloride, and phosphoric acid are formed. Only a small amount was decomposed when heated in a porcelain tube in a current of oxygen over the blast-lamp for several hours. A compound of the structure $P(OH)(NHC_6H_4SO_3H)_4$, was formed by the action of concentrated sulphuric acid on chlorphostetranilide. Acid lead and barium salts were formed by the replacement of six hydrogen atoms in two molecules of the acid. The three toluidines reacted with phosphorus pentachloride and formed compounds of analogous composition.

On the Preparation of Metabrombenzoic Acid and of Metabromnitrobenzene. By H. L. Wheeler and B. W. McFarland. *Am. Chem. J.*, 19, 363-367.—The authors offer the following much improved method for the preparation of metabrombenzoic acid: 20 grams of benzoic acid and 6 grams of iron wire are heated in a flask, connected with a return condenser, to 170°, when 48 grams of bromine are added, drop by drop, while the temperature of the bath is allowed to rise slowly to 260°. After purification and distillation, 20 grams of the pure acid were obtained. Perbrombenzene, C_6Br_6, was formed when 5 grams of benzoic acid, 2 grams of iron, and 37.4 grams of bromine were heated in a tube to 225° for 5 hours. Metabromnitrobenzene was prepared as follows: 30 grams of nitrobenzene and 3 grams of iron were heated to 120°, when 60 grams of bromine were added gradually. A 75 per cent. yield was obtained. Paradichlorbenzene reacts readily with bromine in the presence of iron, giving probably 1,4-dichlor-2,5-dibrombenzene, which melts at 148°.

On the Non-Existence of Four Methenylphenylparatolylamidines. By H. L. Wheeler. *Am. Chem. J.*, 19, 367-374.—Walther (*J. prakt. Chem.*, 55, 41) has described the preparation of four isomeric methenylphenylparatolylamidines. The author has examined the various methods carefully, and comes to the conclusion that they all give the same body, which melts at 103°.5-104°.5.

The Action of Certain Alcohols on Asym-Metadiazoxylenesulphonic Acid. By W. B. Shober and H. E. Kiefer. *Am. Chem. J.*, 19, 381-393.—*a*-metaxylidinesulphonic acid, prepared by the method of Jacobson and Ledderboge (*Ber.*, 16, 193), was diazotized with nitrous fumes. The yield of the diazo compound was 94 per cent. of the theoretical amount. Different portions of the diazo compound were decomposed with methyl, ethyl, and propyl alcohols under varying pressures. In all cases both the hydrogen and the alkoxy reaction took place, the latter to a much larger extent, which increased with increased pressure. a-metamethoxyxylenesulphonic acid crystallizes from benzene in needles, and forms potassium, barium, copper, zinc, and sodium salts. Its amide melts at 190°. a-propoxyxylenesulphonic acid crystallizes from alcohol in needles, and forms well characterized barium, potassium, and zinc salts. Its amide melts at 146°. By the oxidation of a-metamethoxyxylene sulphonamide, an acid of the probable structure $C_6H_2CH_3(1)COOH(3)OCH_3(4)SO_2NH_2(6)+H_2O$ was obtained. The barium and calcium salts were prepared, but did not crystallize well.

The Preparation of Zinc Ethyl. By Arthur Lachman. *Am. Chem. J.*, **19**, 410–411.—By using an improved zinc-copper couple in the preparation of zinc ethyl by the process of Gladstone and Tribe (*J. Chem. Soc.*, **1879**, 570), the author obtained a yield of 70–90 per cent. in half the time required by the old method. The couple is prepared by passing a stream of hydrogen for 20 minutes over a mixture of 100 parts of zinc dust and 12 parts of copper oxide heated to redness in a combustion tube.

A Simple Test for the Halogens in Organic Halides. By J. H. Kastle and W. A. Beatty. *Am. Chem. J.*, **19**, 412–413. —To test for halogens in non-volatile substances about 1 gram is heated with 5 grams of a mixture of equal weights of copper nitrate and silver nitrate until the latter are reduced to oxides. The resulting mixture is treated with a little water, dilute sulphuric acid, and zinc for 5 minutes, filtered, and tested for halogen with silver nitrate. Volatile substances are heated in an S-shaped tube closed at one end, and the vapors passed over a mixture of the nitrates heated to redness. The method was tested with a large number of substances and was successful in every case.

Notes on Caffein. By G. L. Spencer. *J. Am. Chem. Soc.*, **19**, 279–281.—The author compares a gravimetric method for the estimation of caffein proposed by himself (*J. Anal. Chem.*, **4**, 390) with the volumetric method of Gomberg (*J. Am. Chem. Soc.*, **18**, 331), and finds that both give the same result. The volumetric method is to be preferred on account of its wider applicability.

Periodides of Pyridine. By P. F. Trowbridge. *J. Am. Chem. Soc.*, **19**, 322–331.—From a series of experiments on the formation of periodides of pyridine methyl iodide, the author concludes that at ordinary temperatures and with small amounts of iodine, the triiodide is usually formed, and with larger amounts of iodine the pentiodide. When hot saturated solutions were used a heptiodide resulted. Two forms of pyridine hydroiodide are described, $C_5H_5N.HI$ and $C_5H_5N.HI.H_2O$, and periodides containing two, five, and seven iodine atoms. A molecular weight determination in phenol of the unusual periodide containing *two* atoms of iodine showed that its formula is $C_5H_5N.HI.I$.

Modification of the Thalleoquin Test for Quinine. By F. S. Hyde. *J. Am. Chem. Soc.*, 19, 331–332.—It is recommended that very dilute solutions be used in the above test, and a filtered solution of calcium hypochlorite instead of chlorine or bromine water.

G. W. Rolfe, Reviewer.

Allotropy of Sucrose. By F. G. Wiechmann. *J. Phys. Chem.*, 1, 69–74.—The paper records a series of experiments made by the author on an amorphous modification of cane sugar, made by rapidly heating the sugar to boiling, covering the vessel and boiling ten minutes, raising the solution to 176° C., the mass then being rapidly cooled by pouring it on a copper slab. The results point to the conclusion that very minute traces of dissolved inorganic matter tend to cause the sugar to revert to the crystalline form, while, if the sugar is absolutely pure, the amorphous state persists indefinitely.

GEOLOGICAL AND MINERALOGICAL CHEMISTRY.

A. H. Gill, Reviewer.

On the Butanes and Octanes in American (Ohio) Petroleum. By C. F. Mabery and E. T. Hudson. *Proc. Am. Acad. Arts and Sci.*, 32, 101–118; *Am. Chem. J.*, 19, 243-262.—Hitherto it has been assumed that the butane in petroleum was the normal compound; but the results of this investigation show it to be isobutane, and that its boiling-point is 0° instead of —17°; isopentane of boiling-point 29°–30° was also present. Two octanes were obtained, having a boiling-point of 119.5° and 124°-125°, respectively, and specific gravities at 20° of 0.7243 and 0.7134, respectively. The latter is assumed to be the normal compound, but enough could not be obtained to determine its composition. Diisobutyl could not be detected. Attention is called to the fact that the specific gravity of hydrocarbons from this source is greater than that of the same hydrocarbons synthetically prepared, owing probably to the presence of naphthenes.

The Constituents of Pennsylvania, Ohio, and Canadian Petroleum between 150° and 220°. BY C. F. MABERY. *Proc. Am. Acad. Arts and Sci.*, **32**, 121-176.—The author calls attention to the conflicting statements regarding the constituents of the fractions of American petroleums boiling between 150° and 220°. Some believe them to be naphthenes, while others on the basis of Pelouze and Cahours' work, consider that they are members of the fatty series; the author's opinion that the higher portions belonged to the C_nH_{2n} series was not sustained. The separation of these bodies presents greater difficulties than those of the lighter portions, as they must be fractionated *in vacuo*. As it was found that cracking did not begin with the Pennsylvania oils until a temperature above 225° was reached, refinery distillates of a gravity of 48°-50° Baumé were used as the initial material. These were fractionated many times—mention is made of forty-five and fifty distillations—and the distillates treated in some cases with fuming sulphuric acid to remove mesitylene. The Ohio and Canadian distillates were obtained from the crude oils by distillation *in vacuo*. The Pennsylvania petroleum contains a decane of b. pt. 163°-164° and sp. gr. 0.7684, another decane, probably the normal, of b. pt. 173°-174°, sp. gr. 0.7486, an hendecane of b. pt. 186°-197°, sp. gr. 0.7662, and a dodecane of b. pt. 214°-216°, sp. gr. 0.7684. Mesitylene, cumol, pseudocumol, cymol, isocymol, durol, isodurol are probably present in small quantities. Ohio Trenton petroleum, within the same limits, contains the same members; the higher specific gravity of the distillates being caused by a larger proportion of aromatic hydrocarbons. The fractions of Canadian corniferous petroleum from Petrolica, boiling between 163° and 173° contain the same constituents. The hydrocarbons collecting between 196° and 214° are of the C_nH_{2n} series. The proportion of aromatic hydrocarbons is greater in Canadian than in Ohio petroleum.

Refractive Power of the Hydrocarbons and Chlorine Derivatives Described in the Preceding Paper. BY C. F. MABERY AND E. T. HUDSON. *Proc. Am. Acad. Arts and Sci.*, **32**, 179-182.—A comparison of the compounds from Pennsylvania petroleum shows a lower refractive index than the same compound from Ohio and Canadian petroleum, as well as a lower specific gravity. The effect of the second chlorine atom in raising the refractive index is also well illustrated.

On the Composition of a South American Petroleum. BY C. F. MABERY AND A. S. KITTELBERGER. *Proc. Am. Acad. Arts and Sci.*, **32**, 185-191; *Am. Chem. J.*, **19**, 374-381.—The oil came from the Magdalena river, in the United States of Columbia, and was dark and thick, and of 0.948 sp. gr. at 20°. It contained a small quantity of sulphur and was peculiar in the instability of its least volatile portions, that boiling from 310°–345° cracking badly on distillation. It may contain naphthenes and possibly some of the benzene series. It resembles the Russian oils.

W. O. CROSBY, REVIEWER.

A Relatively Acid Dike in the Connecticut Triassic Area. BY EDWARD OTIS HOVEY. *Am. J. Sci.*, 153, 287–292.—One of the striking features of the Triassic igneous rocks of the Atlantic border, from Nova Scotia to North Carolina, is their uniformity in appearance and in mineralogical and chemical composition. The only previously noted variations from the monotony of the diabase traps have been rocks of slightly more basic character. But the author has discovered in the Triassic strata near New Haven, and in intimate association with dikes of the normal diabase, two small dikes of distinctly more acid character. One complete analysis ($SiO_2 = 60.13$) is given, and an analysis of the normal Triassic diabase ($SiO_2 = 51.78$) is quoted for comparison. The composition of the new rock indicates that it belongs to the group of keratophyres.

The Granitic Rocks of the Pyramid Peak District, Sierra Nevada, California. BY WALDEMAR LINDGREN. *Am. J. Sci.*, 153, 301–314.—The granitic rocks include granitite, granodiorite, and diorite. The granodiorite is an intermediate or transition type, and the diorite varies in the other direction to augite porphyrite. Complete bulk analyses of the granitite and granodiorite are given, and partial analyses of both these and the other types. From these analyses the proportions of the component minerals are calculated, the potash, soda, and lime feldspars being distinguished. The paper closes with a brief discussion of the general relations and succession of the rocks, which leaves much to be desired as regards the definiteness of the conclusions stated.

On Roeblingite, a New Silicate from Franklin Furnace, N. J., Containing Sulphur Dioxide and Lead. BY S. L. PENFIELD AND H. W. FOOTE. *Am. J. Sci.*, 153, 413–415.—This new species, from a depth of a thousand feet in the great deposit of zinc ores at Franklin Furnace, is of peculiar interest, from the facts that silicates containing lead are very rare, and that this is the first time that a sulphite has been observed in nature. Although the mineral occurs in dense, white, compact masses, it is definitely known that it cannot be a mixture. The average of two very accordant analyses is: SiO_2, 23.58; SO_2, 9.00; PbO, 31.03; MnO, 2.48; CaO, 25.95; SrO, 1.40; K_2O, 0.13; Na_2O, 0.40; H_2O, 6.35 = 100.32 per cent. The nearest approach to a simple ratio is believed to be $SiO_2 : SO_2 : PbO : RO :$

H_2O = 5 : 2 : 2 : 7 : 5, giving the rather complicated formula $H_{10}Ca_7Pb_2Si_6S_2O_{28}$. The water is driven off at a rather high temperature and is therefore regarded as hydroxyl.

Bacteria and the Decomposition of Rocks. By JOHN C. BRANNER. *Am. J. Sci.*, 153, 438–442.—The author reviews the various published statements concerning the occurrence of bacteria in rocks and soils and their influence upon the decay of rocks, and finds the following conclusions to be more or less probable. The bacteria found in decayed rocks are chiefly the nitrifying forms, which reduce nitrogenous matter to nitric acid. These are not absolutely dependent upon organic food ; that is, they may live in wholly inorganic media, but, in common with all bacteria, they require carbon and nitrogen. They are incapable of separating these elements from the air or water, but can obtain them only from organic bodies and certain salts which occur but rarely, if at all, in ordinary rock formations. Living bacteria are, therefore, practically limited to points near the surface, and to the decayed rocks ; they cannot, then, be a primary or important cause of rock decay.

On Wellsite, a New Mineral. By J. H. PRATT AND H. W. FOOTE. *Am. J. Sci.*, 153, 443–448.—This new species occurs in the Buck Creek Corundum Mine, Clay County, N. C., intimately associated with corundum, albite, and hornblende. The crystallographic and physical features of the mineral show it to be closely related to the phillipsite and harmotome group of zeolites, and this view is fully corroborated by the chemical composition. The average of the two accordant analyses gives: SiO_2, 43.86 ; Al_2O_3, 24.96 ; BaO, 5.07 ; SrO, 1.15 ; CaO, 5.80 ; MgO, 0.62 ; K_2O, 3.40; Na_2O, 1.80 ; H_2O, 13.35 = 100.01. The ratio of $SiO_2 : Al_2O_3$: RO (alkalies and earths) : H_2O is approximately 3 : 1 : 1 : 3, giving the formula $R''Al_2Si_3O_{10}.3H_2O$. Only one molecule of water is given off below 200° C., and regarding this alone as water of crystallization leads to the formula $H_4R''Al_2Si_3O_{12}.H_2O$. A comparison with the other minerals of the phillipsite group, places it at the beginning of the series :

Wellsite	$RAl_2Si_3O_{10}.3H_2O$.
Phillipsite	$RAl_2Si_4O_{10}.4\frac{1}{2}H_2O$.
Harmotome	$RAl_2Si_5O_{14}.5H_2O$.
Stilbite	$RAl_2Si_6O_{16}.6H_2O$.

The analyses of phillipsite vary considerably, and the authors regard 4 : 4 as the most probable normal ratio of $SiO_2 : H_2O$. The minerals then form a regular series in which this ratio is constantly unity. The relations of these minerals to the feldspars are discussed, and the discovery of another member of the series with the $SiO_2 : H_2O$ = 2 : 2, is predicted.

Italian Petrological Sketches, IV. The Rocca Monfina Region. BY HENRY S. WASHINGTON. *J. Geol.*, 5, 241–256.—Rocca Monfina is another one of the extinct and composite Italian volcanoes, but in comparison with those previously described by this author, the order of succession of the lavas is reversed: (1), the leucitic, the oldest, which is subdivided into two sub-phases characterized by leucitites and leucite tephrites; (2), the trachytic; (3), the basaltic, which is the youngest. This is also the order of abundance, the leucitic lavas largely predominating. The petrographic descriptions are in several instances accompanied by chemical analyses. These include: (1) leucite tephrite, of which a widely different analysis by vom Rath is also quoted, the two agreeing closely only in the alumina and soda; and (2), biotite vulsinite, a trachytic rock of which two other analyses are quoted for comparison.

The Bauxite Deposits of Arkansas. BY J. C. BRANNER. *J. Geol.*, 5, 263–289.—This is a full and systematic account of these deposits, which are of great extent, and have a large prospective value. Under the head of composition are given, first, four analyses of ferruginous bauxite, the percentage of iron ranging from 54.2 to 66.83, showing that the bauxites grade into impure iron ores. Two analyses of siliceous bauxite are then compared with an analysis of typical kaolin, to show that kaolin is practically another limit of variation. Finally ten analyses of Arkansas, and three of foreign bauxites are given in tabular form for comparison, the purest Arkansas sample yielding SiO_2, 2.00, and Fe_2O_3, 1.66 per cent. The origin of the bauxite deposits is discussed at some length, the author's view being that they are genetically connected with the eruptive syenite of that region.

Hornblende Basalt in Northern California. BY J. S. DILLER. *Am. Geol.*, 19, 253–255.—This is a study of a water-worn cobble stone, the rock not having been found in place. A complete analysis by L. G. Eakins is given, and three other analyses of hornblende-basalts are quoted for comparison.

On the Genesis of Clay Stones. BY H. W. NICHOLS. *Am. Geol.*, 19, 324–329.—This paper is an application of the modern theories of saturated solutions, to the problem of the clay stone the segregation of mineral substances in the rocks being in general a passage from a more soluble to a less soluble form. Calcium carbonate, for example, changes from aragonite to calcite in the formation of clay stones.

The Anorthosites of the Rainy Lake Region. BY A. P. COLEMAN. *Can. Record Sci.*, 7, 230–235.—Reprinted from *J. Geol.* See *this Rev.*, 3, No. 4.

On the Chemical Composition of Some Kansas Gypsum Rocks. BY E. H. S. BAILEY AND W. M. WHITTEN. *Kan. Univ. Quart.*, **6**, 29–34.—Twelve analyses of gypsum from four different counties are given, and the proportions of the various constituents as they probably exist in the rock are calculated from each analysis. These show that the material is in the main of a high degree of purity, the majority of the analyses closely approximating the theoretical composition of gypsum. The chief impurities are the calcium and magnesium carbonates.

The Leucite Hills of Wyoming. BY J. F. KEMP. *Bull. Geol. Soc. Am.*, **8**, 169–182.—The Leucite Hills, situated in southwestern Wyoming, are surface flows of a highly vesicular leucitic lava. Two analyses are given, one original, and the other quoted from Zirkel, and seven analyses of the leucitic rocks from other regions are also quoted for comparison. The author concludes from the composition and the petrographic features that the rock is best described as leucite phonolite, which shades into leucitites and related types.

Diabase Pitchstone and Mud Enclosures of the Triassic Trap of New England. BY B. K. EMERSON. *Bull. Geol. Soc. Am.*, **8**, 59–86.—The absorption of large volumes of water and mud by the submarine lava flows has caused the mass to cool as a spherulitic glass, with a minute crackling, which gives it a pitchy luster and a large content of water (4.72 per cent.), thus forming a basic pitchstone, which does not seem to have been described before. A single very complete analysis of the pitchstone, by H. N. Stokes, is given, and this shows that the rock is somewhat more basic ($SiO_2 = 46.86$ per cent.) than the normal diabase.

Solution of Silica Under Atmospheric Conditions. BY C. WILLARD HAYES. *Bull. Geol. Soc. Am.*, **8**, 213–220.—The author states that while it is doubtless true that, considered in its relations to other rock-forming minerals, quartz is one of the most insoluble, some recent observations show that under certain conditions now existing at the earth's surface, quartz is by no means proof against chemical, as well as mechanical, agents of erosion. Various observed cases of the solution of silica are then described, including geodes and quartzose conglomerates and sandstones; and it is attributed to the agency of the humic acids. By the oxidation of the vegetable tissues in the process of decay the humic acids are formed, chiefly humic and crenic. These absorb varying quantities of free nitrogen from the air forming the azo-humic acids, which in turn combine with free silica. The resulting complex acids combine with alkaline carbonates, particularly potassium carbonate, to form easily soluble salts. The author regards the presence of potassium carbonate as probably an essential factor in the process. Thenard has shown that the amount of silica dissolved by azo-humic acid is proportional to the content of nitrogen, varying from 7 to 24 per cent.

Erosion at Base-level. By MARIUS R. CAMPBELL. *Bull. Geol. Soc. Am.*, **8**, 221–226.—This paper supplements the preceding one, being an attempt to apply the principle that silica and aluminous silicates (quartz and clay) are readily soluble in swamp waters, in explaining the sharp line of demarcation observed in many Appalachian valleys between the base-leveled bottoms and the lateral slopes.

"Mineral Soap." By W. C. KNIGHT. *Eng. Min. J.*, **63**, 600–601.—This mineral, which it is proposed to call Taylorite, occurs in the Fort Benton shales of southwestern Wyoming. It is a soft, unctuous clay, with a marked soapy feeling in water, and is associated with gypsum and mirabilite. Four analyses are given, which show it to be essentially a siliceous kaolin, the chief impurities other than silica being ferric oxide and magnesia.

Analysis of a Variety of Ilmenite. By GEORGE M. PEEK. *Am. Chem. J.*, **19**, 232.—The material analyzed is from Bedford County, Virginia. It yielded: TiO_2, 63.31; FeO, 35.99; MgO, 0.82; SiO_2, 1.25 = 101.37. This composition affords approximately the formula $Fe_2Ti_3O_8$, which lies between that of typical ilmenite ($Fe_2Ti_2O_6$) and that of iserite ($Fe_2Ti_4O_{10}$).

"Mineral Tallow" from Danby, Vermont. By L. E. SMOOT. *Am. Chem. J.*, **19**, 233.—This peculiar substance forms a layer two to three inches thick on the walls of a limestone cavern. It is of a soft, smooth, putty-like consistency, and entirely devoid of crystalline structure. Analysis gave 85.38 per cent. of water; and the dried material yielded: CaO, 52.19; MgO, 0.27; CO_2, 41.31; SiO_2, 3.57; org. mat. (by diff.), 2.66; nitrogen, 0.053 = 100.00. The organic matter, which forms about the same proportion as in an oyster shell, is regarded as an essential part of the deposit, the conclusion being that this large amount of calcium carbonate has been secreted by some minute form of life.

Analysis of Dolomitic Marble from Texas, Md. By GEORGE C. BUCK. *Am. Chem. J.*, **19**, 234.—The analysis shows that this valuable marble approximates fairly to a true dolomite.

Analysis of an Alum Water from Lee Co., Va. By L. E. Smoot. *Am. Chem. J.*, 19, 234–235.—This water has a strong alum taste, and yielded 3.715 grams per liter of aluminum, iron, and sodium sulphates, the first largely predominating.

Analyses of Infusorial Earth. By F. W. Smither. *Am. Chem. J.*, 19, 235–236.—Three samples were analyzed, from Richmond and King George Cos., Va., and Calvert Co., Md. The second is of exceptional purity, containing 65.83 per cent. of amorphous silica. The chief impurities are quartz and clay, with only traces of lime and magnesia.

[CONTRIBUTION FROM THE MASSACHUSETTS INSTITUTE OF TECHNOLOGY.]

REVIEW OF AMERICAN CHEMICAL RESEARCH.

VOL. III. No. 8.

ARTHUR A. NOYES, Editor; HENRY P. TALBOT, Associate Editor.
REVIEWERS: Analytical Chemistry, H. P. Talbot and W. H. Walker; Biological Chemistry, W. R. Whitney; Carbohydrates, G. W. Rolfe; General Chemistry, A. A. Noyes; Geological and Mineralogical Chemistry, W. O. Crosby; Inorganic Chemistry, Henry Fay; Metallurgical Chemistry and Assaying, H. O. Hofman; Organic Chemistry, J. F. Norris; Physical Chemistry, H. M. Goodwin; Sanitary Chemistry, E. H. Richards; Technical Chemistry, A. H. Gill and F. H. Thorp.

GENERAL AND PHYSICAL CHEMISTRY.

A. A. NOYES, REVIEWER.

Fourth Annual Report of the Committee on Atomic Weights. Results Published in 1896. BY F. W. CLARKE. *J. Am. Chem. Soc.*, **19**, 359–369.—A summary is given of the atomic weight determinations published during the preceding year. The mean results referred to oxygen as 16, are given below. The values adopted by Clarke, in his report of last year, are inserted in parentheses for the sake of comparison.

Hydrogen (THOMSEN, *Ztschr. anorg. Chem.*, **12**, 4), 1.0083 (1.0076).
Silver (HARDIN, *J. Am. Chem. Soc.*, **18**, 990), 107.928 (107.92).
Nitrogen (HIBBS, *J. Am. Chem. Soc.*, **18**, 1044), 14.0117 (14.04).
Arsenic (HIBBS, *J. Am. Chem. Soc.*, **18**, 1044), 74.916 (75.09).
Magnesium (RICHARDS AND PARKER, *Ztschr. anorg. Chem.*, **13**, 81) .... 24.362 (24.29).
Cadmium (HARDIN, *J. Am. Chem. Soc.*, **18**, 990), 112.027 (111.93).
Mercury (HARDIN, *J. Am. Chem. Soc.*, **18**, 990), 199.989 (200.0).
Tellurium (CHIKASHIGE, *J. Am. Chem. Soc.*, **69**, 881), 127.59 (127.0).
Tungsten (SCHNEIDER, *J. prakt. Chem.*, **53**, 288), 184.01 (184.84).
Tungsten (SHINN, *Dissertation*)............184.91 (184.84).

The article closes with a revised table of atomic weights.

The Nature of the Chemical Elements. Argon and Helium in the Periodic Sequence. BY CHARLES SKEELE PALMER. *Proc. Col. Sci. Soc.*, Jan. 4, 1897, 1–10.—The article is extremely hypothetical and visionary. Many of the statements are only verbally intelligible.

Mass Law Studies, II. By S. F. Taylor. *J. Phys. Chem.*, 1, 461–473.—See *this Rev.*, 3, 75.

Solubility and Freezing Point. By D. McIntosh. *J. Phys. Chem.*, 1, 474–492.

On Potassium Lead Iodide. By J. M. Talmadge. *J. Phys. Chem.*, 1, 493–498.

H. M. Goodwin, Reviewer.

Surface Tension of Water and of Dilute Aqueous Solutions. By N. Ernest Dorsey. *Johns Hopkins Univ. Circ.*, 16, 44. —The author employed Lord Rayleigh's method of "ripples" for determining the surface tension of water and aqueous solutions of sodium chloride, potassium chloride, sodium carbonate, potassium carbonate and zinc sulphate, of concentrations varying from 0.05 normal to normal. The method gave results accurate to about one-seventh per cent. The value found for pure water was $T_w = 75.98$ dynes per centimeter, at 0° C. For the solutions employed it was found that the surface tension was a linear function of the concentration, and could be expressed by the formula $T_s = T_w + kC$. The values found for K are given below: NaCl, 1.53; KCl, 2.23; $\frac{1}{2}Na_2CO_3$, 2.00; $\frac{1}{2}K_2CO_3$, 1.77; $ZnSO_4$, 1.86.

Velocity of Silver Ions in Aqueous and Alcoholic Solutions. By W. T. Mather. *Johns Hopkins Univ. Circ.*, 16, 45–46.—Experiments upon the effect of temperatures ranging from 0° to 50° on the transference numbers of silver nitrate and acetate in aqueous solution, confirmed the law well established by Brin, that the value approaches 0.5 with rising temperature. (Both of these salts have already been very carefully investigated by Loeb and Nernst.) In absolute alcohol the transference number for the anion NO_3 was found about 10 per cent. greater than in water, while in a 50 per cent. solution the value was the same. The results are published as preliminary.

ANALYTICAL CHEMISTRY.

ULTIMATE ANALYSIS.

H. P. Talbot, Reviewer.

Determination of Potash and Phosphoric Acid in Fodders. By H. W. Wiley. *J. Am. Chem. Soc.*, 19, 320–322.—The procedure described is a modification of the Lindo-Gladding method, and provides for the determination of the phosphoric acid and potash in the same sample, if desired. By this method ten samples may be examined per day without sacrifice of accuracy.

Sodium Peroxide as a Third Group Reagent. BY S. W. PARR. *J. Am. Chem. Soc.*, 19, 341–346.—The peroxide throws down from a nitric acid solution of the sulphides of the group, iron, manganese, cobalt and nickel, while the zinc, aluminum and chromium remain in solution, the latter undergoing oxidation to chromate, thus avoiding interference with the zinc. A scheme is given for the further separation of these metals. The procedure proposed in the presence of phosphates, involving the addition of tin, appears to be less satisfactory.

On the Determination of Silica in Blast Furnace Slag. BY G. H. MEEKER. *J. Am. Chem. Soc.*, 19, 370–374.—The dehydration of the silicic acid by means of concentrated sulphuric acid, instead of by heat, is the essential feature of the procedure, for which both rapidity and accuracy are claimed. The filtrate from the silica thus obtained cannot, however, be utilized for the determination of either aluminum or calcium. The method yields satisfactory results in the presence of spinel.

The Determination of Lead in Lead Ores. BY RICHARD K. MEADE. *J. Am. Chem. Soc.*, 19, 374–377; *Eng. Min. J.*, 63, 313.—It is proposed to treat the ore in a platinum vessel with nitric and sulphuric acids, and after the removal of the former, to add hydrochloric acid and expel the excess. The remaining lead sulphate is then filtered and ignited as usual. Other metals forming insoluble sulphates must be absent.

Note on the Separation of Silicic and Tungstic Acids. BY JAMES S. DE BENNEVILLE. *J. Am. Chem. Soc.*, 19, 377–379.—The author points out that silica is not insoluble in ammonia and that the volatilization method, recommended by Arnold (*Steel Works Analysis*), is unquestionably preferable for the separation of these acids.

The Electrolytic Determination of Cadmium. BY S. AVERY AND BENTON DALES. *J. Am. Chem. Soc.*, 19, 379–382 and 513.—The authors find that the double oxalate and acetic acid methods for the determination of cadmium are unsatisfactory; the cyanide method yields fair results with relatively large amounts of cadmium, and the formate method yields satisfactory results, provided certain conditions, which they prescribe, are rigidly maintained.

Note on the Volatility of Boric Acid; Separation of Boric and Phosphoric Acid; Estimation of Boric Acid in Foods. BY L. DE KONINGH. *J. Am. Chem. Soc.*, 19, 385–388.—Experimental evidence is offered to show that boric acid is not appreciably volatile with steam, until the solution is evaporated nearly to dryness. Calcium chloride is employed to throw down phosphoric acid, when present, before the titration of boric acid. The use of zinc oxide in food analysis to remove the phosphoric acid is proposed. Its efficiency has not been fully established.

The Volumetric Determination of Lead. By J. H. Wainwright. *J. Am. Chem. Soc.*, 19, 389–393.—The procedure proposed is a modification of one already given in *Crookes' Select Methods.* The lead is precipitated by means of potassium bichromate, from an acetic acid solution, using a solution of silver nitrate as an outside indicator. The author claims that the method is rapid and of moderate accuracy. The paper is somewhat confused by the unfortunate use of *carbonate* for *chromate* on pages 390 and 392.

Analysis of Phosphor Bronze, Phosphor Copper, Phosphor Tin, Etc. By Max Wickhorst. *J. Am. Chem. Soc.*, 19, 396–398.—The paper presents detailed procedures for the determination of phosphorus in any of the alloys named, and for the complete analysis of phosphor bronze.

Notes on the Estimation of Cyanogen by Silver Nitrate, Using Potassium Iodide and Ammonia as Indicators. By William J. Sharwood. *J. Am. Chem. Soc.*, 19, 400–434.—The paper presents the results of an exhaustive study of the reaction between the cyanide and the nitrate under varying conditions. The results can hardly be briefly summarized ; reference must therefore be made to the original article.

Qualitative Separations with Sodium Nitrite in Absence of Phosphates, Etc. By Gillett Wynkoop. *J. Am. Chem. Soc.*, 19, 434–436.—The author finds that iron, chromium and aluminum are precipitated completely by sodium nitrite from a boiling solution containing a small quantity of free acid, while nickel, cobalt, zinc and manganese are not thrown down. The separation seems to be more complete than that effected by the use of barium carbonate.

Table for the Calculation of Analyses. By Edward Barton and John Navarre Marcomb, Jr. *Kansas Univ. Quart.*, 6, 59–60.

W. H. Walker, Reviewer.

Determination of Arsenic in Copper and Cupriferous Solutions. By Titus Ulke. *Eng. Min. J.*, 63, 454.—About ten grams of the sample are treated with a mixture made up of equal parts of strong hydrochloric acid and a saturated solution of ferric chloride, and repeatedly distilled. All the arsenic is then found in the colorless distillate as arsenious chloride, and may be determined either by titration with standard iodine solution, or gravimetrically as arsenious sulphide.

[Contribution from the Massachusetts Institute of Technology.]

REVIEW OF AMERICAN CHEMICAL RESEARCH.

Vol. III. No. 9.

Arthur A. Noyes, Editor; Henry P. Talbot, Associate Editor.
Reviewers: Analytical Chemistry, H. P. Talbot and W. H. Walker; Biological Chemistry, W. R. Whitney; Carbohydrates, G. W. Rolfe; General Chemistry, A. A. Noyes; Geological and Mineralogical Chemistry, W. O. Crosby; Inorganic Chemistry, Henry Fay; Metallurgical Chemistry and Assaying, H. O. Hofman; Organic Chemistry, J. F. Norris; Physical Chemistry, H. M. Goodwin; Sanitary Chemistry, E. H. Richards; Technical Chemistry, A. H. Gill and F. H. Thorp.

ANALYTICAL CHEMISTRY.

ULTIMATE ANALYSIS.

W. H. Walker, Reviewer.

The Complete Analysis of Chrome Ore. By A. G. McKenna. *Proc. Eng. Soc. Western Pa.*, 63, 180–182.—The dried sample is fused in a nickel crucible (platinum is very easily attacked by this reagent) with an excess of sodium peroxide for a few minutes. This ensures complete decomposition of the ore, after which the sodium chromate formed is dissolved and determined volumetrically with a standard solution of a ferrous salt. The other constituents of the ore are separated and determined by the usual quantitative methods.

PROXIMATE ANALYSIS.

G. W. Rolfe, Reviewer.

A Recalculation of Wein's Table of Starch Equivalent to Copper Found Based on the Factor 0.92. By William H. Krug. *J. Am. Chem. Soc.*, 19, 452.—This factor, 0.92, is that suggested by Wiley as the mean between Nägeli's, 0.918, and 0.925 of Ost.

An Analytical Investigation of the Hydrolysis of Starch by Acids. By G. W. Rolfe and Geo. Defren. *Tech. Quart.*, 10, 133–166.—A revision of an earlier article in the same journal.

The Determination of Reducing Sugars in Terms of Cupric Oxide. By Geo. Defren. *Tech. Quart.*, 10, 167–182.—A revision of an earlier paper.

Improved Method for the Determination of the Specific Gravity of Molasses. By J. C. Boot. *La. Planter and Sugar*

Mfr., 18, 415.—The author suggests a modification of Sidersky's method (*Ztschr. für Rübenzucker Indus.*, *1881*, 192) in which a potassium carbonate solution of approximately the same specific gravity as the molasses is used to dilute the latter to the required volume. This obviates the necessity of determining the exact volume of the molasses itself by a separate weighing. The author shows that the error introduced under ordinary conditions is not over one one-thousandth.

F. H. THORP, REVIEWER.

Method of Drying Sensitive Organic Substances. BY C. C. PARSONS. *J. Am. Chem. Soc.*, 19, 388.—The moisture in such substances as soap, wood pulp, and the like, may be determined by dividing the material into small, thin pieces and introducing these directly into a known weight of paraffine oil, which has been heated for some time to 250° C., before using. The mixture is put into a hot closet at 240° C., for a few minutes, and then weighed. The loss is called moisture. The operation seldom requires more than twenty minutes, and no decomposition of the substance takes place under the oil.

W. R. WHITNEY, REVIEWER.

Riegler's Method for Estimating Sugar in Urine. BY HENRY C. C. MAISCH. *Am. J. Pharm.*, 69, 294–296.—The author gives reasons for his adverse criticism of the method for the determination of sugar in urine by means of Fehling solution, pointing out the fact, confirmed by his own experimental investigation, that other reducing bodies than sugars may, by their presence, introduce errors. He recommends the method of Rübner, or Penzoldt's modification. This is a colorimetric test, the sugar being estimated by the depth of color in the precipitate which ammonia produces in the urine after it has been treated with lead acetate solution, and filtered.

Notes on Opium Assaying. BY FRANK X. MOERK. *Am. J. Pharm.*, 69, 343–350.—These notes are valuable additions to the methods for the assaying of opium. The author recognizes the imperfections of all existing methods, and points to the need of more exact processes. Tables are given showing some results and exhibiting variations which are inconsistent with perfect methods, but which make evident the comparative value of the lime-water method.

Analytical Processes and Laboratory Notes. BY CHAS. LAWALL. *Am. J. Pharm.*, 69, 350–352.—Directions for a rapid and accurate method for the determination of caffeine in kola, guarana, coffee, etc., are given. The material is treated with dilute ammonia and shaken out with chloroform. The filtered solution, on evaporation, leaves the fat and alkaloid, from which the fat is extracted with ether and the dried residue weighed. A note concerning the estimation of alkaloids in white hellebore follows, and the article concludes with a discussion of the purity of so-called "C. P." chemicals. The reviewer cannot agree with the author in his opinion concerning the use of "C. P.," and would deprecate the advancement of the idea that the "U. S. P." requirements represent a higher degree of purity than our older well-known "C. P." should. The mark "C. P." ought to indicate such a degree of purity of a preparation that present chemical methods can show no appreciable impurity, and the consequent and necessarily infrequent use of the term "chemically pure" should then be an evidence of its strict propriety.

The Estimation of Menthol in Oil of Peppermint. By CLEMENS KLEBER. *Pharm. Rev.*, 15, 135.—This paper presents a brief comparison of the author's method for the determination of menthol with that of Kebler, and concludes with a rapid, approximate method, in which a comparison is made of the titration value (in terms of sodium hydrate) of a definite quantity of acetic anhydride with the value of the same quantity after boiling 30 minutes with the oil containing menthol.

TECHNICAL CHEMISTRY.

F. H. THORP, REVIEWER.

Artificial Silk in Germany. By GEORGE SAWTER. *U. S. Consular Rep.*, 54, 107–110.—The paper gives a brief description of the Lehner process for the production of artificial silk from wood pulp (see *U. S. Consular Rep.*, 48, 266), and also of the Seyfert process for its production from cotton yarn. The cotton is treated with a cold solution of caustic soda of 30° Bé., and then dried on a stretcher reel, under strong tension. The yarn is afterwards thoroughly washed, and dyed. The new artificial silk is very strong, non-inflammable, and it is claimed that washing does not injure its lustre.

Quebracho Tanning in Uruguay. By EDGAR SCHRAMM. *U. S. Consular Rep.*, 53, 495.—The advantages of quebracho wood as a tanning material and as lumber, are well presented. For use in tanning, the entire log is chipped up to a coarse sawdust and leached in much the same manner that oak bark is treated. It is claimed to be richer in tannins than oak bark.

Photography in Natural Colors. By FRANK H. MASON. *U. S. Consular Rep.*, 53, 518–521.—This is a popular account of a new process, invented by M. Chassagne. An ordinary dry plate is treated with an unnamed colorless solution, and then exposed, developed, and fixed in the usual manner, producing a monochromatic negative. Sensitized paper or gelatine film is also treated with the colorless solution and printed by contact, in the usual way. The print appears like an ordinary one, but is said to have acquired the power of selective absorption for dyes, so that if it is passed successively through solutions of red, green, and blue dyes, a proportionate amount of each color is taken up locally, to reproduce the colors of the natural object. No information is given as to the nature of the liquids used.

Manufacture of Phosphor Bronze. BY MAX H. WICKHORST. *J. Am. Chem. Soc.*, 19, 393–395.—The phosphorus added to bronze to deoxidize the metal may be introduced as phosphorus or as a high phosphorus alloy, called "hardener." This contains six per cent. of phosphorus, with copper and tin in the ratio of eight to one. The "hardener" is made by melting 90 pounds of copper and adding 11 pounds of tin. Seven pounds of phosphorus are put into a dilute solution of blue vitriol, until coated with metallic copper. This protects the phosphorus when it is dried in the air. After drying, the sticks of copper-plated phosphorus are introduced into the melted bronze, two or three at a time, and held below the surface of the metal by a cup-shaped tool. The phosphorus melts and combines with the metal at once, to form "hardener."

On the Manufacture of Dynamite. BY G. E. BARTON. *J. Am. Chem. Soc.*, 19, 500–509.—This paper presents a description of the plant and the method used in the manufacture of dynamite. Two classes of dynamite are recognized: that consisting of nitroglycerol absorbed in wood pulp, or kieselguhr, with various fillers, such as sodium nitrate, etc.; and those called gelatin dynamites, consisting of nitroglycerol, gelatinized with nitrated cellulose. The first class is discussed in this article. The numerous precautions to be taken in arranging and in operating the plant, the tests of materials and yields obtained, are all shown. The treatment of the spent acids is also considered, and recovery by running through a Glover tower is advised. The mixing of the nitroglycerol with the absorbent is best done in a wheel-mill with wooden wheels. For packing the dynamite in the cartridge papers, wooden pack-sticks are best.

The Commercial Preparation of Nitronaphthalenes. BY WILLIAM H. KRUG AND J. E. BLOMÉN. *J. Am. Chem. Soc.*, 19, 532–538.—Nitronaphthalenes are chiefly used in nitroglycerol explosives, to reduce sensitiveness to concussion and to prevent freezing of the dynamite. It also increases the solvent action of nitroglycerol on nitrated cellulose. The nitronaphthalenes used should be as highly nitrated as possible. In order to determine the conditions necessary for the best yield, the authors tried nitrating naphthalene-sulphonic acid under various conditions, and also nitrating naphthalene directly. It was found that the yield of nitronaphthalene decreased proportionally to the degree of sulphonation in the case of α-naphthalenesulphonic acid. Direct nitration of naphthalene gave better yields, and the best results were obtained by using a mixture of nitric acid 26° Bé., and sulphuric acid, the quantity of the latter depending on the degree of nitration desired. For low melting products, four parts of nitric to one of sulphuric were used; for high melting products, three parts to two. An excess of sulphuric acid chars the product, producing much tar.

BIOLOGICAL CHEMISTRY.

E. H. RICHARDS, REVIEWER.

Dietary Studies. The Food of the Negro in Alabama. BY W. O. ATWATER AND CHAS. D. WOODS. *U. S. Expt. Sta. Bul.* No. 38, 1–69.—This report gives in detail the food consumed by eighteen families living in the neighborhood of Tuskegee, Ala., and is by far the most comprehensive contribution to this vital question for the whole race. The cost per man per day ranged from two and one-quarter to nineteen and three-quarters cents. Ten dietaries cost less than eight cents and seven less than six cents per day, yet only five gave an abnormally low fuel value. As might have been predicted from the experience of employers, the nitrogenous substances were uniformly low. Fourteen of the twenty dietaries (two families were tested in both winter and summer) contained from one-fourth to one-half the required proportion.

Dietaries of the Public Institutions of the City of Boston. BY E. H. RICHARDS AND S. E. WENTWORTH. *Rep. of the Institutions Dept., City Document 14, 1897,* 206–219.—The authors make a statement of the facts established by their investigation, and recommend certain standards for the different classes of public institutions.

Dietary Studies in New Mexico. BY ARTHUR GOSS. *U. S. Agr. Expt. Sta. Bull.*, No. 40, 1–23.—This Bulletin contains important data not elsewhere found, in the form of analyses of food materials used in the Central American regions, and the dietaries are of more than usual interest in view of our limited knowledge of the food of the Mexicans, both as to quality and cost.

Here, as elsewhere, sufficient food seems to be procurable at a cost of from six to nine cents per person daily.

The Fruit Soils of Oregon and the Composition of Oregon Prunes. By G. W. Shaw. *Reprint from Ore. Expt. Sta. Bull*, *No.* 45, 1–98.

Removal of Iron from Ground Waters. By H. W. Clarke. *J. N. E. Water Works Assoc.*, 11, 277–284.—The author suggests the use of coke as a more efficient filtering material than sand for the removal of iron from certain classes of waters, and in support of this view gives the results of experiments at Provincetown, Mass.

The Iron Removal Plant at Reading, Mass. By Lewis M. Bancroft. *J. N. E. Water Works Assoc.*, 11, 294–300.—The use of lime and alum for the removal of iron from a water which does not yield to simple aeration and filtration, is described, and a table of analyses given.

W. R. Whitney, Reviewer.

Internal Secretion Considered from a Chemico-physiological Standpoint. By R. H. Chittenden. *Science*, 5, 967–977.—The author treats exhaustively a single internal secretion, that of the rudimentary gland of the neck, the thyroid, known as the seat of the goitre. The effects on the metabolism of persons and animals (both normal and thyroidectomized), brought about by the administration of the gland, or its extracts, are pointed out. These, together with the recognized change produced in the blood and upon the quantity of mucus in different parts of the body, afford sufficient evidence that this vestigial gland produces one or more secretions necessary to the animal body. Concerning the chemical and physiological nature of the principal product, which the author calls "a proteid of peculiar constitution," not much is known. It is peculiar in that "it tends to hold a certain amount of iodine in combination," and yields on decomposition by acids or gastric juices, iodothyrin, a nonproteid, difficultly decomposable compound containing phosphorus and iodine. The physiological action of iodothyrin is further considered, as well as the presence of a relatively high percentage of iodine in the material of the gland.

The Nitrogen-free Extract of Plants and Feeding Stuffs. By B. Tollens. *U. S. Expt. Sta. Rec.*, 8, 641–661.—This article is introduced by a detailed consideration of the constituents of the so-called carbohydrates of food material, and attention is called to the fact that other substances which are not strictly carbohydrates are here classed as such. Uncertainties regarding the proper method of analysis of crude fiber are also pointed out, and some erroneous notions regarding the food value of these constituents are corrected. The author properly recognizes the true value of the well-known Wende extraction method and points out the need for more exact and discriminating procedures.

The Root of Phytolacca Decandra. Part II. BY S. B. FRANKFORTER AND F. RAMALEY. *Am. J. Pharm.*, 69, 281–290.—The paper opens with abstracts of the literature concerning the chemical composition of the root. Of the results of their own investigations, the authors give the percentages of substance extracted by common solvents; a summary of analyses showing the amount of wax, resin, proteids, starch, acid (formic), etc., present; and the results of the study of the sugar extracted. No body of a glucosidal or alkaloidal nature was detected.

On the Occurrence of Strontium in Plants. BY HENRY TRIMBLE. *Am. J. Pharm.*, 69, 296–297.—The author has demonstrated the presence of strontium in several samples of bark and points to the fact that little or no attention has been given to its possible presence in the ashes of plants other than sea plants.

Alfalfa or Lucern; Its Chemical Life History. BY JOHN A. WIDTSOE. *Bull. Utah Agr. College*, 48, 1–73.—The paper presents a thorough discussion of the subject, and is so arranged as to show the composition of successive crops of the lucern. It is supplemented by a discussion of the connection between the analytical results and the value of the material as a fodder.

The Normal Urine. BY CHARLES PLATT. *J. Am. Chem. Soc.*, 19, 382–384.—This paper presents a table showing the mean results of many urine analyses made by the author and by others, and gives the extremes of composition between which the normal urine may lie, including practically all of its constituents.

The Proteids of Lupin Seeds. *J. Am. Chem. Soc.*, 19, 454–482; **The Proteids of the Sunflower Seed.** *Ibid*, 487–493; **The Proteids of the Cow Pea.** *Ibid*, 494–500; **The Proteid of the White Podded Adzuki Bean.** *Ibid*, 509–512. BY T. B. OSBORNE AND G. F. CAMPBELL.

AGRICULTURAL CHEMISTRY.

F. H. THORP, REVIEWER.

Alkali. BY B. C. BUFFUM. *Wy. Sta. Bull.*, *No.* 29, 219–253.—In this paper are given the details of a study of alkali in soil and its effects upon plants. "White alkali" consists principally of sulphates of sodium and magnesium; one per cent. of these salts in the first two inches of surface soil renders it unproductive, except for plants which can inhabit alkali soils. These are sugar-beets, white clover, sages, and alfalfa. A comparison of the temperatures of alkaline and non-alkaline soils was made, but no difference was detected.

The Value of Manure from Animals Fed on Linseed Meal. By H. Snyder. *Minn. Agr. Expt. Sta. Bull., No.* 47, 23.—Pigs were fed on linseed meal and potatoes, and produced daily six pounds of urine and two pounds of dung. The total quantity of nitrogen in the two was 0.09 pound, while that in the food was 0.10 pound. A very large part of the nitrogen was thus returned to the soil when the linseed cake was used as feed.

The So-called "Natural Plant Food" a Soft Phosphate. By A. D. Selby. *Ohio Agr. Expt. Sta. Bull., No.* 71, 178–184.—An analysis showed "natural plant food," (see this *Rev.*, 3, 41,) to be, in part at least, Florida or Tennessee soft phosphate. A comparison between it and other standard fertilizers with reference to its action in hastening or retarding germination, showed that it retards germination as compared with unfertilized soil, although some of the standard fertilizers exert a still greater retarding action.

Ammonium Thiocyanate as an Impurity in Ammonium Sulphate. By H. J. Wheeler and B. L. Hartwell. *R. I. Agr. Expt. Sta. Rep., 1895*, 281–286.—This is a record of experiments with pure ammonium sulphate, and that containing ammonium thiocyanate, on oats. The results demonstrate the poisonous action of the thiocyanate on such plants.

Analyses of Commercial Fertilizers. *Agr. Expt. Sta. Bull., Vt.*, 58 and 59, and 9th Ann. Rep., *1896*; *Mass. Hatch Sta., No.* 45; *Ky., No.* 68; *R. I. Sta. Rep., 1895*, 39, 287–293; *Mich., No.* 135; *S. C. Sta. Rep., 1895*, 54–63; *Mass. Hatch Sta., 9th Ann. Rep.*, 202–223; *Penn. Dept. Agr. Bull.*, 19; *Cal. Sta. Rep., 1895*, 135–139; *La., Series 2, No.* 45, 56–80; *Penn. Sta. Rep., 1895*, 227–236; *R. I. No.* 40, 71–79; *Wis., No.* 53; *Canada Expt. Farms Rep., 1895*, 206–219.

The Fertilization of Land. By E. W. Hilgard. *Cal. Agr. Expt. Sta. Rep., 1895*, 123–135.—The effect of crops on the fertility of the soil in California is considered, and the fertilizer requirements studied. The general conclusions reached show that, with the exception of a few localities, the soils of the state contain an abundance of lime, and that acid soils are rare. There is also sufficient potash in most localities, and often an excess. The rainfall being generally deficient, this ingredient is not washed away; but the greater part of California soils are deficient in phosphoric acid, and phosphates are the chief fertilizers now required by the farmers. Nitrogen is generally present, but in some localities may need to be supplied. Next to phosphates, nitrogenous fertilizers are probably most in demand, except in the alkali regions, where an excess of nitrogen is present.

Analysis of Paris Green. E. W. HILGARD. *Cal. Agr. Expt. Sta. Rep., 1895*, 137.—The percentage of arsenious acid is stated for two samples.

Experiments with Soluble, Reverted, and Insoluble Phosphoric Acid. BY E. H. HESS. *Penn. Agr. Expt. Sta. Rep., 1895*, 157–210.—The author concludes that soluble phosphates are too expensive to use on lime soils, where equally good results are obtained with insoluble phosphates; also that ground bone is superior to ground Carolina phosphate rock.

Composition of Wood Ashes Sold in Pennsylvania. BY W. FREAR. *Penn. Agr. Expt. Sta. Rep., 1895*, 224–226.—Analyses of fifteen samples are given, with comments.

Some Pennsylvania Peats. BY W. FREAR AND E. J. HALEY. *Penn. Agr. Expt. Sta. Rep., 1895*, 148–156.—The value of peat as a fertilizer is shown by the analyses of thirteen samples. Although bulky, it offers a fertilizer well worth consideration; some varieties, however, need composting with lime or with stable manure.

Origin, Value, and Reclamation of Alkali Soils. BY E. W HILGARD. *U. S. Dept. Agr. Yearbook, 1895*, 103–122.—Among other subjects discussed in this article are "the influence of irrigation on the movement of alkali," and the "composition of alkali salts."

Inspection of Paris Green. BY W. C. STUBBS. *La. Agr. Expt. Sta. Bull., No.* 45 (*2nd Ser.*).—Analyses of eight samples are given.

Investigation on the Foraging Powers of Some Agricultural Plants for Phosphoric Acid. BY L. H. MERRILL AND W. H. JORDAN. *Maine Sta. Rep., 1895*, 10–18.—This paper is a continuation of the study of the fertilizing value of insoluble, as compared with soluble phosphates. Among other conclusions it is stated that young plants feed chiefly on soluble phosphaes, while with older plants the insoluble forms are assimilated. The solubility of phosphate in ammonium citrate is not considered a true measure of the availability of phosphoric acid to the plants.

Certain varieties of plants appear better able to assimilate insoluble phosphates than do others.

G. W. ROLFE, REVIEWER.

The Occurrence of Raffinose in American Sugar-Beets. BY W. E. STONE AND W. H. BAIRD. *J. Am. Chem. Soc.*, 19, 115-124.—The paper presents a discussion bearing upon the occurrence of raffinose in beet-sugar, in which are given the results of the researches of the authors on Nebraska beet-root molasses. They find by a modification of the Kodyl-Sheibler method that raffinose is present. The authors also note the remarkable fact that raffinose in very small amounts changes the character of cane-sugar crystals, so that they closely resemble those of pure raffinose. They illustrate this by photo-micrographs.

The Sugar-Beet. BY H. W. WILEY. *Farmers' Bull. U. S. Dept. of Agr., No.* 52, 1-47.—The paper is intended to give concise information in a popular way on the raising of sugar-beets, a comparison of the different varieties, and the effect of climate, soil, fertilizers, irrigation, etc., on the quality of the beets. Methods of cultivation and manufacture, as well as data on the cost are also given. A number of statistical tables on the world's sugar production are added.

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REVIEW OF AMERICAN CHEMICAL RESEARCH.

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ARTHUR A. NOYES, Editor; HENRY P. TALBOT, Associate Editor.
REVIEWERS: Analytical Chemistry, H. P. Talbot and W. H. Walker; Biological Chemistry, W. R. Whitney; Carbohydrates, G. W. Rolfe; General Chemistry, A. A. Noyes; Geological and Mineralogical Chemistry, W. O. Crosby; Inorganic Chemistry, Henry Fay; Metallurgical Chemistry and Assaying, H. O. Hofman; Organic Chemistry, J. F. Norris; Physical Chemistry, H. M. Goodwin; Sanitary Chemistry, E. H. Richards; Technical Chemistry, A. H. Gill and F. H. Thorp.

INORGANIC CHEMISTRY.

HENRY FAY, REVIEWER.

A Study of Ferric Hydroxide in Precipitation. BY VERNON J. HALL. *Am. Chem. J.*, **19**, 512–525.—To ascertain whether the reaction between ferric chloride, potassium hydroxide and potassium sulphate takes place according to the equation

$$Fe_2Cl_6 + 6KOH + 4K_2SO_4 = Fe_2(OH)_6 + 6KCl + 4K_2SO_4,$$

and to learn whether the precipitation is affected by occlusion, solutions of each of these compounds were prepared and carefully standardized. Precipitation of the ferric hydroxide from solutions, each containing the same amount of iron, were made with eight, six, five, four, three, and two molecules of potassium hydroxide, and the resulting precipitate and filtrate analyzed for potassium and sulphuric acid. All of the potassium and sulphuric acid should appear in the filtrate if the reaction proceeds according to the equation. Using six molecules of potassium hydroxide none of the sulphuric acid was found in the precipitate, but 0.48 per cent. of the potassium (K_2O) was carried down. On diminishing the amount of potassium hydroxide below six molecules none of the potassium was found in the precipitate. On the other hand, 11 per cent. of sulphuric acid (SO_3) appeared in the precipitate at five molecules, 11.5 per cent. at four, and 9.53 per cent. and 5.52 per cent. at three and two molecules, respectively. When the amount of potassium hydroxide was increased to eight molecules, more potassium was carried down in the precipitate, while all of the sulphuric acid appeared in the filtrate. It appears from these results that potassium sulphate as such is not carried down in the precipitate, but that the ferric hydroxide has the power of decomposing it. In a second series the reaction

$$2FeCl_3 + 6KOH = 2Fe(OH)_3 + 6KCl$$

was tested in the same way, by analyzing the precipitate and filtrate for potassium and chlorine to see what effect the potassium chloride had upon the precipitation of ferric hydroxide. With six molecules the chlorine was undisturbed; at points short of complete precipitation the amount of chlorine in the precipitate decreases as the amount of the hydroxide passes from five and one-half molecules to five, and so on. In a third series the same reaction as in the first series containing potassium sulphate was tested, to see how much chlorine was carried down. From the results it appears that the ferric hydroxide acts on the potassium sulphate in preference to the potassium chloride. The author concludes that the facts observed are inconsistent with the theory of adhesion, but that they are characteristic of chemical action.

Corrosive Sublimate in Calomel. By LYMAN F. KEBLER. *Am. J. Pharm.*, 69, 338–340.—The author has found that calomel occasionally contains corrosive sublimate, but according to the most rigid tests all calomel, with a single exception, examined during several years, has not contained over 0.00001 per cent. of corrosive sublimate.

Notes on Lucium. By WALDRON SHAPLEIGH. *J. Franklin Inst.*, 144, 68–70.—The author has shown that the precipitate with sodium thiosulphate, on which great stress is laid as a reaction for "lucium," can be produced by heating a concentrated solution of the double sulphates of the yttrite group and potassium, and that the precipitate is due to the heat alone and not to the presence of the thiosulphate. One kilogram of monazite sand was worked over, following the directions set forth in the patent of M. Barrière without obtaining any earth corresponding to the reactions of "lucium."

The Action of Iodine on Solutions of Stannous Chloride. By S. W. YOUNG AND MAXWELL ADAMS. *J. Am. Chem. Soc.*, 19, 515–525.—By treating iodine with excess of stannous chloride solution, there is formed stannic iodide with subsequent formation of stannous iodide, and other products, probably producing a state of equilibrium, which varies with the quantities used and the temperature of the reaction.

The Ferrocyanides of Zinc and Manganese. By G. C. STONE AND D. A. VAN INGEN. *J. Am. Chem. Soc.*, 19, 542–547.—Both zinc and manganese form different salts in neutral and acid solutions, the composition of the salts varying according as the ferrocyanide or the metallic salt is in excess. It was found impossible to titrate the excess of ferrocyanide unless the conditions are always maintained absolutely the same. Among the indicators cobalt gave the best results.

On the Ferrocyanides of Zinc and Manganese. BY EDMUND H. MILLER AND J. A. MATHEWS. *J. Am. Chem. Soc.*, 19, 547–558.—The precipitates formed by potassium ferrocyanide and zinc or manganese chlorides are double ferrocyanides, the composition of which varies with the increase or decrease of one of the constituents. The precipitate formed in a dilute hydrochloric acid solution of zinc chloride by potassium ferrocyanide has the composition represented by the formula $Zn_3K_2(Fe(CN)_6)_2$, which confirms the accuracy of the ordinary method for the quantitative determination of zinc and manganese.

METALLURGICAL CHEMISTRY.

H. O. HOFMAN, REVIEWER.

Heat Requirement of the Silver-Lead Blast Furnace. BY L. S. AUSTIN. *Eng. Min. J.*, 63, 634–635.—The author starts with a certain charge consisting of foul slag, bedded ore, siliceous ore, roasted ore, fine dust, oxidized lead ore, and limestone, to be melted with 15 per cent. coke, calculates the resulting products, slag, matte and speiss and base bullion, assumes the composition and temperature of the escaping gases and calculates how the coke charged will be used up. He finds that nearly 82 per cent. of the heat value of the fuel is consumed in the formation of the slag and the reduction of carbon dioxide to monoxide.

Standard Practice in Bessemerizing Copper Mattes. BY C. W. PARSONS. *Eng. Min. J.*, 63, 481–483.—This is the first article on the subject giving full practical details of the manner of working.

The Present Status of Pyritic Smelting. BY H. LANG. *Eng. Min. J.*, 64, 37–38.—This is a defense of the work done by the author at Keswick, Cal. The points of interest in the lengthy article are that in the absence of alumina the single silicate of iron forms the most desirable slag; that the concentration of copper in matte is governed principally by the amount of silica present; and that an excess of silica causes accretions to form and particles of quartz to be mechanically suspended in the slag, while a lack results in the production of a low-grade matte. While in the absence of alumina, slags with about 30 per cent. silica were satisfactory, with alumina the percentage of silica ran from 20 to 40 per cent. The author claims, as a result of his work: (1) Charges with not more than 33 per cent. of sulphide can be smelted with 2½ per cent. coke, making a high concentration; (2) the slags can be made as clean as those from matting copper ores; and (3), as stated above, silica governs, to a great extent, the degree of concentration.

The Pelletan-Clerici Process at the De Lamar Mill, Idaho. By D. B. Huntley. *Eng. Min. J.*, **64**, 155-156.—This is an illustrated description of a plant and process which aims to extract by electro-amalgamation, gold and silver from ore to which a small amount of potassium cyanide has been added. The essential parts of the plant are two classes of agitators, 5 upper ones, 8 feet in diameter and 8½ feet deep, receiving through a launder the pulp from the stamp batteries and Huntington mills, and discharging at intervals into 10 lower ones, 8 feet 8 inches in diameter and 4 feet deep, and holding 2½ tons of ore, into which the thick pulp is discharged to be electro-amalgamated. A lower agitator has on the wooden bottom a copper plate forming the cathode, while the vertical shaft, geared from above and having 4 arms bearing sheet-iron plates (4 feet long, 14 inches wide, and ½ inch thick) forms the anode. The pulp in the amalgamator (which has been charged with 600 pounds quicksilver, covering the bottom ½ inch) receives from 2½ to 3 pounds potassium cyanide and 6 pounds of salt per ton of ore and is treated for 11½ hours, the shaft making 20 revolutions per minute, the current being of 10 volts (amperage not given). The amalgam formed is removed twice a month and worked in the usual way. The ore is a decomposed quartz porphyry carrying from 0.25 to 0.50 per cent. concentrates, the valuable mineral is partly oxidized gold- and silver-bearing iron sulphide, from ⅔ to ⅘ of the value of which is gold. By raw amalgamation it yields from 40 to 50 per cent. precious metal, the use of salt and blue stone somewhat increases the extraction and the new process takes out about 80 per cent. of the values.

Roasting Previous to Cyaniding. By W. MacGregor. *Eng. Min. J.*, **64**, 187-188.—The author advocates that, in treating gold ores by the cyanide process, the question of roasting should receive more consideration than it does at present, as there would be a higher extraction of gold, a lower consumption of cyanide, the ores would filter more rapidly, the solutions become less charged with soluble salts, and the use of lime or soda ash as neutralizer would become unnecessary. In experimenting, laboratory tests should be supplemented by small working tests, with from 1 to 10 tons of ore. Stress is laid on roasting the ore absolutely dead. In order to see if an ore has been dead-roasted in large scale work the author recommends the following procedure: Take from 100 to 250 grams of ore, place it in a beaker with some 200 cc. of water, stir and filter, and add slowly to the filtrate cyanide solution of the same strength as the working solution. If no cloudiness appears, the ore is fitted for cyanide treatment; if a brown coloration results, the cyanide consumption will be high; if a blue coloration soon becoming a bluish-green precipitate, the ore is badly roasted.

A Plant for Parting Low-Grade Bullion. BY F. GUTZKOW. *Eng. Min. J.*, 64, 218.—This paper gives an illustrated description of a plant and an outline of the practical details for carrying out the author's new process noticed in *this Rev.*, 3, 101.

Changes in Cyanide Mill Solutions. BY PH. ARGALL. *Biennial Rep. Colo. School Min., through Eng. Min. J.*, 64, 246. The subjoined analyses show how little change a mill solution from roasted ore undergoes, if carefully handled, the normal strength being kept up by the addition of fresh cyanide.

	Solution.			
	Before precipitation.	After precipitation.	After six months' use.	After eighteen months' use.
KCN	0.501	0.451	0.535	0.410
HCN	0.061	0.079	0.017	0.021
Total simple cyanides	1.302	1.335	1.470	1.445
$KyFe(CN)_6$	0.098	0.117	0.018	0.026
KCNS	0.212	0.207	0.058	0.057
Zn	0.316	0.360	0.368	0.388
CaO	0.085	0.082	0.172	0.172
Au (oz.)	1.15	0.037	1.81	0.03

During the six months 11,000 tons of ore were treated, during eighteen months, 26,000 tons.

Limitation of the Cyanide Process. BY PH. ARGALL. *Biennial Rep. Colo. State School Min., through Eng. Min. J.*, 64, 246.—The cyanide process is used only for oxidized ores containing gold in a fine state of division; if coarse gold is present, this has to be recovered by amalgamation either before or after cyanide treatment. Copper ores are soluble in dilute cyanide solutions, the copper accumulating up to a certain point when it is thrown down in the zinc boxes. Skey proved the solubility of chalcopyrite and copper glance, as well as that of sulphide of antimony. He believes that very small amounts of sulphur decrease the dissolving power of cyanide for gold; the author did not find this to be the case in working on a large scale. Galena is soluble in cyanide, but does not interfere with the solution of gold; blende and pyrite are insoluble.

The Accumulation of Amalgam on Copper Plates. BY R. T. BAGLISS. *Trans. Am. Inst. Min. Eng.*, 26, 33–38, 1039–1051. —The paper calls attention to the differing quantities of gold and silver found in the amalgam daily collected, the hard amalgam accumulating on the copper plates and the copper plates themselves at the gold mill of the Montana Mining Co., Marysville, Mont. The ore treated has a quartz ore gangue, contains argentiferous native gold in a very fine state of division, active silver in wire and leaf form, sulphides of iron and copper, and traces of lead, arsenic, antimony, and zinc; it assays one-half ounce gold and from 7 to 12 ounces silver per ton. The ore is stamped in a battery through a 30-mesh sieve, amalgamated on apron plates and passed over a Frue Vanner having an amalgamated distributor; the tailings are subsequently amalgamated in pans. An apron plate, of one-eighth inch rolled copper plate and electroplated with one ounce of silver to the square foot, was taken out after being in constant use for three years and ten months, the amalgam scale (ranging in thickness from sixteen-hundredths to one-sixteenth inch) removed by striking back and front and by scraping with a chisel. The amalgam recovered from the plate (8 feet long and 54 inches wide) weighed 160 pounds avoirdupois, yielded 38 per cent. bullion of 993.9 fineness, *viz.*, gold 431.4 and silver 562.5, representing a value of $8,340.54. In another case a plate yielded $11,000.00. The retorted amalgam from the daily clean-ups was 985.4 fine, *viz.*, gold 541.5 and silver 443.9; that from the accumulated scale 993.9, *viz.*, gold 431.4 and silver 562.5; that from the amalgamated copper plate on the Frue Vanner 982.5, *viz.* gold 380.5 and silver 602.0; the cleaned apron plate, when run into a bar, had absorbed 8.96 ounces gold and 9.62 ounces silver. Thus in regard to total fineness, the order of the amalgams was: accumulated scale (993.9), daily clean-up (985.4), Vanner plate (982.5), and in regard to the ratio of gold and silver, daily clean-up (123 : 100), absorbed by copper plate (93 : 100), accumulated scale (76 : 100), and Vanner plate (63 : 100). The author believes that chemical and not mechanical causes, as suggested in the discussion, must furnish the explanation for the excessive accumulation of scale and for the variations in the values of the different amalgams.

Notes on the Handling of Slags and Mattes at Western Works. By W. Braden. *Trans. Am. Inst. Min. Eng.*, **26**, 38–53.—The paper is an illustrated description of the different methods in use for separating the increasing amounts of matte formed in the treatment of silver-lead ores, and of disposing of the slag produced by blast furnaces, the capacity of which has been nearly doubled in the last five years.

The Volatilization of Silver in Chlorodizing Roasting. By L. D. Godshall. *Trans. Am. Inst. Min. Eng.*, **26**, 53–62.—This paper is a reply to Mr. C. A. Stetefeldt's criticism (*this Rev.*, **1**, 331) of the author's "A Review of the Russell Process," which appeared in *Proc. Colo. Sci. Soc.*, **4**, 306–322.

Notes on the Walrand-Legenisel Steel-Casting Process. By H. L. Hollis. *Trans. Am. Inst. Min. Eng.*, **26**, 134–138.—In making steel for casting, open-hearth metal must be employed if sound castings are to be obtained. The process in question supplements the Bessemer operation in such a way as to permit the making of castings directly from the converter. It does this by adding ferro-silicon, containing from 10 to 12 per cent. silicon, to the converter at approximately the time when the flame drops and then making an after-blow. The result is a steel strongly superheated (on account of the high calorific power of silicon), free from blowholes (as the product of combustion is a slag and not a gas), very fluid and one which permits the making of intricate castings down to a fraction of a pound in weight. The paper outlines the mode of working used at the Legénisel and Cruizot works in France, at the works of Hagen, Prussia, and those of the Potter and Hollis Foundry Co., Chicago, Ill. The advantages of the process are that, the converter being small (600–1500 pound charges), the cost of installation is low, that, being heated up in about one hour, the plant need not be working continuously, that the process is cheap, that it furnishes cheaply small quantities of steel of the desired composition of such fluidity that small intricate castings can be made and that green sand can be used, if the castings are not to be machined. It is claimed that the same results can be obtained in a basic converter by substituting high-phosphorus iron for ferro-silicon.

The Effect of Additions of Titaniferous to Phosphoric Iron Ores in the Blast Furnace. By A. J. Rossi. *Trans. Am. Inst. Min. Eng.*, **26**, 144–149.—The author shows by a number of fusions carried on in graphite crucibles that the tendency of titanium to throw the carbon in pig iron into the combined state is modified by the presence of phosphorus, the effect being the greater the larger the percentage of phosphoric acid in the mixture. He believes that by mixing titaniferous and phosphoric ores in the correct proportions, two classes of ores, of little value at present, can be smelted in the blast furnace, furnishing a foundry iron sufficiently strong for most purposes.

The Sulphuric Acid Process of Treating Lixiviation Sulphides. By F. P. Dewey. *Trans. Am. Inst. Min. Eng.*, **26**, 242–263.—This paper, which was read simultaneously before the American Chemical Society and the American Institute of Mining Engineers, was discussed in *this Rev.*, **2**, 99.

Action of Blast Furnace Gases upon Various Iron Ores. By O. O. Laudig. *Trans. Am. Inst. Min. Eng.*, **26**, 269–278. Discussion by F. E. Bachman and R. H. Sweetser. *Ibid*, 1061–1071.—These experiments were undertaken to find out if it is possible to determine by laboratory experiment what processes go on in the blast furnace. Different iron ores, thirty-three in number, representing magnetite, different kinds of hematite, limonite, iron and steel scale, flue and puddle cinder were tested in sizes ranging from one-eighth inch to that passing through a 100-mesh sieve. The samples were separately heated in a small iron vessel for three hours to a temperature of about 432° C., first in a current of air that had been passed through caustic potash, pyrogallate of potash, and sulphuric acid, and then in a current of blast furnace gas, the composition of which [CO_2 7.4, CO 31.0, and CO_2 7.8, CO 27.0] gave the proportions of one CO_2 to 4.19 and 3.16 CO, respectively. The deposited carbon in the gas-heated sample having been determined, the weight of the air-heated ore deducted from the gas-heated ore (minus its carbon) gave the weight of the oxygen lost. Full details of the manner of experimenting are given. Nearly all the ores, with the exception of scales, cinders, and magnetites, after treatment showed a considerable increase in bulk, those depositing the most carbon showing the greatest. Thus Mesabi ores deposited 21.61 per cent. carbon, soft hematites 13.82, hard hematites 7.52, blue ores 3.08, cinders and scales 0.38, and magnetites hardly any. Carbon deposition and reduction bore no direct relation to each other, as was expected, except that when there was a large carbon deposition, there was also a large amount of oxygen lost. The mechanical effect of deposited carbon is to disintegrate the ore, thus opening the pores for the action of the carbonic oxide, and work in the blast furnace showed that ores absorbing the largest amount of carbon required the least amount of fuel per ton of iron. Ores that are easily reduced without carbon deposition must be very porous. The carbon-deposition has little to do with the carbon contents of the pig iron. Mr. Bachman, in his discussion, attributes the troubles occasioned by the use of fine Mesabi ores to their great increase in bulk, *viz.*, twice the original volume after the carbon has been burned off and four or five times taking carbon and ore together, as they choke up the interstices between the lumpy coke and limestone. In order to do satisfactory work, he says, it is necessary to have a charge which would make enough slag to give a regular-working furnace and take up all the sulphur without giving more than 2 per cent. in the cinder, and an ore-mixture which will give up its oxygen rapidly and uniformly at the lowest temperature, each ore to deposit enough carbon to thoroughly disintegrate it, to convert all the carbon dioxide of the flux to carbon monoxide and to remove all the oxygen from the ore that is not taken up by the carbon monoxide.

The Occurrence and Behavior of Tellurium in Gold Ores, more Particularly with Reference to the Potsdam Ores of the Black Hills, South Dakota. BY FRANK CLEMES SMITH. *Trans. Am. Inst. Min. Eng.*, **26**, 485–515, 1103–1108.—The chemical part of this paper refers to the assay, the roasting, and metallurgical treatment of tellurium gold-silver ores. In assaying, the author found that work in the crucible gave higher results than that in the scorifier, the charge—ore 0.25, sodium bicarbonate 1.00, litharge 2.00, argol 0.10, assay tons—giving the highest results with the Blue and Red Potsdam ore of the Black Hills, analysis of which gave: Blue ore, SiO_2 68.748, Al_2O_3 3.072, Fe 13.289, S 11.728, $CaSO_4\ 2H_2O$ 0.833, CaF_2 0.784, P_2O_5 0.842, and in ounces per ton Te 4.03, Au 0.325, Ag 1.055. Red ore, SiO_2 84.45, Al_2O_3 4.07, Fe_2O_3 7.28, CaO 0.85, MgO 0.25, SO_3 3.71, and in ounces per ton Te 8.426, Au 0.576, Ag 2.875. The tellurium mineral, which is sylvanite, was found to be very evenly distributed in both classes of ore.

In cupelling, it was found that the loss by absorption and volatilization increased with the percentage of tellurium. Selenium had an effect similar to that of tellurium.

In roasting, very rich tellurium gold ore assaying as high as 180.66 ounces gold and 2041 ounces silver per ton, losses of 14.06 ounces gold and 29.46 ounces silver per ton were encountered, while with Potsdam ore (22.80 ounces gold and 3.16 ounces silver per ton), the loss was 0.04 ounces gold and 0.32 ounces silver per ton, and with Cripple Creek (Colo.) ore (109.6 ounces gold and 667.71 ounces silver per ton) it was 3.60 ounces gold and 38.21 ounces silver per ton. The average loss in roasting Potsdam ores, ranging from 0.72 to 5.20 ounces gold and from 0.87 to 58.52 ounces silver per ton, was after 20 minutes, 5.281 per cent. gold and 4.074 per cent. silver, and after 60 minutes 11.446 per cent. gold and 8.438 per cent. silver.

The author suggests that the treatment of the gold precipitate obtained in chlorinating works might be modified and the tellurium saved. Ordinarily the precipitate is roasted and then melted with fluxes, causing loss of all the tellurium and a considerable percentage of gold. By treating the slimes with nitric acid, all loss may be avoided and the tellurium recovered from the solution.

The Use of the Tremain Steam Stamp with Amalgamation. BY E. A. SPERRY. *Trans. Am. Inst. Min. Eng.*, **26**, 545–553.—A description of the results obtained at the Cross mill, Gunnison County, Colo., with the stamp, the use of which is very limited in milling gold ores.

The Cyanide Process in the United States. BY G. A. PACKARD. *Trans. Am. Inst. Min. Eng.*, **26**, 709–721.—The author, who has had considerable experience in the cyaniding of ores visited the leading works of the country, and reviews the present state of the process. The gold ores treated are low-grade, have with a few exceptions a siliceous gangue, and contain small percentages of base metal. With silver ores some good results have been obtained, although the time required and the large consumption of cyanide, as a rule, exclude this class of ores. Chlorination is a rival of cyaniding, and on account of the higher extraction of gold is more used, where proximity to a railroad permits the transportation of the large amount of chemicals required, *e. g.*, at the Golden Reward Mill, Deadwood, S. D., 35 versus 2½ pounds per ton. Amalgamation can compete with the cyanide process only when very finely divided gold ores are to be worked in pans. Then follow the practical details of the method of leaching. the manner of precipitating, the consumption of reagents, and the cost.

Solution and Precipitation of the Cyanide of Gold. BY S. B. CHRISTY. *Trans. Am. Inst. Min. Eng.*, **26**, 735–772.—This paper is a systematic study of the subject embodying a summary of the researches made by the author since 1891, and requires an extended review. As to the solution of gold in potassium cyanide, MacArthur held that Elsner's equation was wròng, while MacLaurin's investigations proved it to be correct and further showed that the rate of solubility went through a maximum in passing from concentrated to dilute solutions, which fact is explained by the decrease of solubility of oxygen in cyanide with the concentration of the latter. The author verified the necessity of the presence of oxygen, showing that with a limited air supply the solution stopped when the oxygen had been exhausted, and began again when it was supplied. He reasons that in the cyanide solution the oxygen and potassium cyanide may be present without acting one upon another until the gold is introduced, starting the reaction, when nascent cyanogen attacks the gold. The necessity of the presence of oxygen being proved, experiments were made with other oxidizing agents than the oxygen of the air, such as potassium chlorate, nitrate, permanganate, and ferricyanide as well as with the peroxides of barium, manganese, lead, and sodium. They all proved effective, potassium ferricyanide and the peroxides of sodium and manganese more so than the others. If cyanogen bromide be added to potassium cyanide, there are formed potassium bromide and cyanogen and this in the presence of gold and an excess of potassium cyanide gives potassium aurocyanide. It was found more convenient to add dilute bromine water to a cyanide solution than to use cyanogen bromide. It is essential in the use of these reagents that in the presence of an excess of potassium cyanide, they shall not be added faster than the cyanogen set free can combine with the gold; if this rule is not observed, the free cyanogen will be converted into paracyanogen and oxidized products which, being ineffective, simply diminish the amount of active reagent. Bromine and cyanogen bromide can be replaced by chlorine and iodine and their respective cyanogen compounds. Comparing chlorine, bromine and oxygen, weight for weight, 1 gram chlorine causes the solution of 2.45 grams gold, 1 bromine 5.52 gold, and 1 oxygen 24.5 gold; experiments proved that oxygen gave as good, if not better, results than chlorine and bromine, if properly applied, although the latter was more convenient, being more readily soluble in water. With low-grade ores and dilute solutions no additional oxidizing agent is required, if the solution be well aerated, unless the ore or the water contains some reducing agent; with rich ores and correspondingly stronger solutions, an artificial oxidizer may be of distinct advantage. The author experimented upon the solubility of sulphide, telluride, and antimonide of gold. As the sulphide cannot be produced in the dry way, sulphide prepared in the wet way served as a basis of the experiments. It was found to dissolve readily, more quickly in a concentrated than in a dilute solution. In the solution there was always found to be present potassium sulphide and sulphocyanate and in most cases suspended sulphur, which makes it probable that beside the potassium aurocyanide, there are formed in the solution potassium sulphide and free sulphur, the former acting upon the gold sulphide gives potassium aurosulphide and the sulphur set free from both reactions combines wholly or in part with potassium cyanide to sulphocyanate. Tellurides of gold and silver dissolve with the greatest difficulty, the probable reason for this being that the affinity of potassium for tellurium is much smaller than that of sulphur and that the tendency of tellurium to form tellurous acid retards the oxidation and thereby the solution. Antimonide of gold behaved in a way similar to telluride, white oxide forming in solution. In the study of the precipitation of gold from cyanide solutions the author found that the generally accepted statement that upon acidifying a solution of potassium aurocyanide with sulphuric acid a yellow precipitate of aurocyanide separated was only true when the solution had been evaporated down and become concentrated and that metallic gold was separated from this salt only by the strongest hot sulphuric acid. He believes that a compound $HAuCy_2$, aurocyanhydric acid, similar to the ferro- and ferri-cyanhydric acids is formed. Before accepting the existence of the new gold compound, he had thought that in an acidified cyanide solution the gold was kept dissolved by the liberated hydrocyanic acid and experimented to find, whether in driving off the hydrocyanic acid the gold could not be separated and at the same time the acid be recovered by passing over potash or lime, which readily absorb it. Upon acidifying a one per cent. solution no trace of hydrocyanic acid appeared, yet, when it was kept for weeks near caustic potash, this was found to have absorbed nearly all the acid. In order to accelerate the process, air and then the steam with air were blown through the solution, the hydrocyanic acid of which was reduced in 3 hours from 1 to 0.003 per cent. By using absorption towers, steam can be dispensed with in large scale work and if sufficient time be given, the absorption towers may not be necessary. From 80 to 90 per cent. of the acid was recovered in the laboratory experiment. In case a stock solution contained alkaline sulphides, these would have to be removed previous to acidifying by treatment with lead carbonate or sulphate. But even when the hydrocyanic acid had been reduced to 0.01 per cent., the solution containing as much as 0.1 per cent. of gold remained clear and the usual precipitants, oxalic acid, sulphurous acid, hydrogen sulphide, etc., failed to throw down any gold. An excess of silver nitrate, however, precipitated the gold completely, while lead and quicksilver nitrates did it only in part. Oxidizing agents, such as potassium permanganate, peroxides of manganese, and lead in acid solution facilitated the precipitation. In precipitating gold by filtering through charcoal, the author found that its power was very limited, as it took up not more than 0.2 per cent. gold, although within this limit it acted completely and promptly, but the presence of free potassium cyanide lowered the capacity ; acidification raised it. The difficulty of recovering the gold from the charcoal puts it out of consideration for practical use. Precipitation with mercuric chloride was satisfactory only in the absence of free potassium cyanide and when the solution was brought to a boil, then a yellow cyanide of gold fell out which at a low red heat turned to pure gold. The mercury can be recovered from the filtrate by adding the requisite amount of potassium sulphide, and thus the cyanide in solution regenerated. Under-precipitation does no harm, as the solvent is used over again. For the reasons stated above, this precipitant can come into play only under very limited circumstances. As one of the requisites of all ore to be suited for the cyanide process is that it shall contain little or no soluble copper compounds, it seemed to the author that they might be used as precipitants. In immersing sheet-copper in a solution with 0.33 gram of gold, a light-yellow precipitate began to form in the liquid and only very little of it on the copper; after 3 days 75 per cent. of the gold had been precipitated, and after 11 days only 0.011 gram remained in solution. This, of course, was too slow for practical work. Experiments with copper sulphide stirred into the solution showed that if this was neutral and alkaline, two-thirds, and if acidulated with sulphuric acid, the whole of the gold was thrown down in a few hours. Cupric sulphide obtained in the wet way, precipitating one-fifth of its weight of gold, acted better than cuprous sulphide prepared in the dry way. Removal of free hydrocyanic acid, if in excess of 0.1 per cent., assisted the precipitation. From the precipitate the gold sulphide was dissolved with potassium sulphide after making alkaline. The gold from the solution could be recovered by electrolysis and the cupric sulphide freed from gold be ready to be used over again. Instead of stirring the copper sulphide into the solution this may be filtered through the sulphide; the author prefers the first procedure. Preparing cupric sulphide in the acidified solution by adding cupric sulphate and then hydrogen sulphide worked as satisfactorily as stirring in the sulphide. Provided the free hydrocyanic acid had been removed, 1 pound of copper as sulphate will precipitate 3.11 pounds of gold. In precipitating with copper compounds it was found that no copper whatever went into solution; this pointed to the solution that the precipitate was mainly a salt of the aurocyanhydric acid, either cuprous aurocyanide or the corresponding sulpho salt. The author then experimented with cuprous chloride and found that a white precipitate containing all the gold formed at once, the metallic copper present as cuprous chloride precipitating twice its weight of gold. All the cuprous salts were found to be effective, even cuprous cyanide. As the precipitate obtained by cuprous hyposulphite is soluble both in potassium cyanide and sodium hyposulphite, a complete precipitation can only be had from an acidified solution. The method employed by the author was to add sulphuric acid to the solution, to remove the hydrocyanic acid by aëration after, or by fine sulphate before acidifying, and then to precipitate with cuprous chloride prepared by adding salt to a cuprous sulphate solution and saturating with sulphurous acid. The precipitate, $CuAuCy_2$, is insoluble in dilute acids, readily so in potassium cyanide; the gold is easily extracted. The author then criticizes the de Wilde process. This consists (1) in leaching the ore with a 0.05 per cent. potassium cyanide solution containing about the same amount of soda or lime, (2) in recovering the excess of alkaline cyanide by neutralizing the free alkali and precipitating with ferrous sulphate, and (3) in precipitating the gold as aurous cyanide with cuprous cyanide, formed by introducing sulphurous acid and adding cupric sulphate. He found that the precipitate of ferrous cyanide was very bulky, took weeks to filter, and was constantly changing in composition, and argues that it is not an easy matter to extract the cyanide from the precipitate. While the precipitation of gold is sharp and complete, it takes a long time to form and to settle. He, therefore, prefers his method of making the cuprous salt outside of the solution with concentrated reagents, which works more quickly. In reviewing the precipitation of gold, by means of electricity, from a dilute solution with insoluble anode, the author argues that the great resistance can only be overcome by very large electrode surfaces and energetic artificial circulation, and that if all the gold is to be precipitated, this cannot be done without destroying most of the cyanide. Another disadvantage observed by the author is that gold is not only deposited on the cathode but also on the anode, and that a gold-bearing precipitate settles out from the electrolyte. An acidulated solution worked better than one that was neutral or alkaline, but the cyanide was destroyed unless special precautions were taken. The difficulties can be overcome, as in South Africa (see *this Rev.*, 2, 102) but it requires great technical skill. The method in common use for precipitating gold is by means of metallic zinc, although it has the disadvantage of great consumption of zinc, unnecessary destruction of cyanide, loss in working the precipitate and the failure of the zinc in certain cases to throw down any gold at all. The excess of the consumption of zinc in practice over what is required theoretically (1 oz. Zn : $\frac{1}{6}$–$\frac{1}{15}$ oz. Au *vs.* 1 oz. Zn : 6.2 oz. Au) is explained by the solvent effect of the free alkali, the excess of potassium cyanide and the oxygen dissolved in the water ; the failure of zinc sometimes to precipitate gold is attributed to polarization and to the formation of a film of zinc cyanide in the absence of free potassium cyanide. The ordinarily accepted reaction,

$$2AuKCy_2 + Zn = K_2ZnCy_4 + 2Au,$$

does not explain the different phenomena. The author suggests that in the absence of free potassium cyanide the reaction is

$$4KAuCy_2 + 4Zn + 2H_2O = 2ZnCy_2 + ZnCy_2.2KCy + ZnK_2O_2 + 4H + 4Au,$$

and in the presence of free potassium cyanide,

$$2KAuCy_2 + 3Zn + 4KCy + 2H_2O = 2Au + 2(ZnCy_2.2KCy) + ZnK_2O_2 + 4H.$$

He then discusses the recovery of potassium cyanide from strong solutions of zinc sulphate, the precipitation of aurous cyanide by means of zinc chloride and oxychloride, gives the advantages of the method with cuprous salts and outlines the mode of operation. He concludes his splendid paper with some satisfactory results that he obtained in treating high-grade ores, while previously the process had been applied only to those of a low tenor and predicts a far greater field for the process than it occupies to-day.

Notes on the Cyanide Process. BY J. E. CLENNELL. *Univ. Sci. Press*, 74, 256. This is an open letter addressed to Professor Christy reviewing the paper just abstracted, the criticisms being based on large-scale work and laboratory experiments made in South Africa.

Laboratory-Tests in Connection with the Extraction of Gold from Ores by the Cyanide Process. BY H. VAN F. FURMAN. *Trans. Am. Inst. Min. Eng.*, 26, 721–734.—The paper gives full details of the methods in common use to determine by preliminary treatment, whether an ore is suitable for the process or not, and to control the work in the mill. It embraces the character of ore; size to which it should be crushed; question of preliminary roasting; strength of solution; time of leaching; rate of percolation; testing of water to be used in the mill; determination of acidity; test for the consumption of cyanide; test for percentage of extraction; determination of the cause of cyanide-consumption; of the free potassium cyanide in solution; of the free hydrocyanic acid in solution; of the total simple cyanides in solution; of the ferro-, the ferri-, and the sulpho-cyanides in solution; of the zinc and lime in solution and of the gold and silver in solution. A useful abstract can not be made without reproducing nearly the entire paper.

The Value and Use of Aluminum, Manganese, and Silicon in the Brass Foundry. BY F. J. DAVIS. *Aluminum World*, 3, 141–142.—The alloy of copper with from 10 to 11 per cent. aluminum is one of the strangest known, its tensile strength ranging from 80,000 to 90,000 pounds per square inch. It also has a high elastic limit, but a low percentage of elongation (5 per cent. in one inch). The presence of silicon increases its strength and hardness, but decreases its ductility. Of the brasses the one containing 3.50 per cent. aluminum, 33.3 per cent. zinc, the rest being copper, is the best and strongest, having a tensile strength of from 75,000 to 85,000 pounds per square inch. The addition of 0.1 per cent. silicon to melted copper before pouring makes the bath more fluid and gives clean and solid castings free from blow-holes. Silicon acts in a similar way upon brass and tin bronze mixtures. Two silicon-copper alloys (bronzes) are commonly used to-day, *viz.*, the alloy of 5 per cent. silicon and 95 per cent. copper, which is strong and tough, having a tensile strength of 75,000 pounds per square inch and 8 per cent. ductility, and the alloy of 3 per cent. silicon and 97 per cent. copper, which has a tensile strength of about 55,000 pounds per square inch and from 50 to 60 per cent. ductility. If more than from 5 to 5½ per cent. silicon be added to the copper it becomes brittle. Of the manganese bronzes free from iron, the one having the composition Cu 53, Zn 42, Mn 3.75, Al 1.25, makes a very strong and tough alloy, suited for propeller wheels, gears, etc., and for mining screens, as it is not attacked by acid mine waters. The alloy, Cu 67.25, Mn 18.50, Zn 13.00, Al 1.25 forms a good substitute for German silver.

Notes on Malleable Cast Iron. By G. C. Davis. *Am. Manuf.*, 60, 728, *and Iron Age*, 59, No. 19, 5.—From the examination of a large number of malleable castings the author comes to the following conclusions as to what their composition should be. Silicon should range from 0.60 to 0.90 per cent.; if it runs below 0.50 per cent. the casting will be too tough; if above 1 per cent., too brittle; sulphur from 0.04 to 0.12 per cent.; phosphorus from 0.15 to 0.22 per cent., a higher percentage making the casting brittle; manganese from 0.20 to 0.40 per cent.; the percentage of carbon varies with the cross-section of the casting and the time of annealing—thus, castings one-eighth inch thick to show 0.15 per cent. carbon, three-sixteenths—0.64 carbon, five-sixteenths—1.03 carbon, nine-sixteenths—1.58 carbon. The carbon is sometimes more completely removed than these figures indicate. The author obtained his samples for the determination of carbon by breaking the casting, filing across the fracture and collecting the filings on a sheet of paper.

ASSAYING.

H. O. Hofman, Reviewer.

An Improved Muffle. By A. S. Dwight. *Trans. Am. Inst. Min. Eng.*, 26, 992–994.—This muffle, devised by Mr. H. F. Wierum, assayer of the Colorado Smelting Co., Pueblo, Colo., has two sets of horizontal ribs on the inner sides, running from front to back, which serve to support a loose slab of burned fire-clay used to regulate the heat of the different parts of the muffle.

Silver Losses in Cupellation. By L. D. Godshall. *Trans. Am. Inst. Min. Eng.*, 26, 473–484.—The silver losses in cupellation are due to absorption by the cupel and volatilization. The author has determined the combined loss from these two sources and studied the effects of a variable quantity of silver, of the weight of the lead button and the nature of the cupel. While the investigation is of much value as far as the commercial assay is concerned, it would have been of greater scientific interest if the temperatures had been measured and the speed of the air-current passing through the muffle determined.

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ARTHUR A. NOYES, Editor; HENRY P. TALBOT, Associate Editor.
REVIEWERS: Analytical Chemistry, H. P. Talbot and W. H. Walker; Biological Chemistry, W. R. Whitney; Carbohydrates, G. W. Rolfe; General Chemistry, A. A. Noyes; Geological and Mineralogical Chemistry, W. O. Crosby; Inorganic Chemistry, Henry Fay; Metallurgical Chemistry and Assaying, H. O. Hofman; Organic Chemistry, J. F. Norris; Physical Chemistry, H. M. Goodwin; Sanitary Chemistry, E. H. Richards; Technical Chemistry, A. H. Gill and F. H. Thorp.

GENERAL AND PHYSICAL CHEMISTRY.

A. A. NOYES, REVIEWER.

On the Permeation of Hot Platinum by Gases. BY WYATT W. RANDALL. *Am. Chem. J.*, 19, 682–691.—After giving a brief review of the previous work done on the permeation of metals by gases, the author describes the apparatus used in his own experiments. This consists of a platinum tube closed at one end, fitted into a hard-glass tube, and connected at its protruding open end with a Töpler pump and a sparking tube for examining the spectrum. The hard-glass tube and the platinum tube within it are heated to a white heat, a high vacuum is produced in the latter, and carefully dried hydrogen or other gas to be tested is passed through the outer tube. It was found that hydrogen passed through the platinum, though only very slowly, the pressure within the tube (total volume 100 cc.) increasing at the rate of a millimeter in 3–5 minutes. The spectrum indicated that the hydrogen which had passed through the platinum was perfectly pure. On the other hand, when the platinum tube was surrounded with dry air, the vacuum within could be maintained indefinitely. Like oxygen and nitrogen, methane seemed to have no power whatever of permeating the metal.

The Atomic Mass of Tungsten. BY WILLET LEPLEY HARDIN. *J. Am. Chem. Soc.*, 19, 657–676.—The author has investigated the methods commonly employed in determining the atomic weight of tungsten, consisting in the reduction of its trioxide by hydrogen, and in the reoxidation of the metal by ignition in the air. The results are given of sixty-four determinations made with the material from different sources. From the discordant results obtained, the author concludes that the method is unsatisfactory, and that this may be due to the action of the substance on the vessel in which it is ignited, to loss mechanically or by volatilization, or to the presence of nitrogen as impurity, all of which sources of error were demonstrated to be actually present.

Mass Law Studies, III. BY S. F. TAYLOR. *J. Phys. Chem.*, 1, 542–546.—See *this Rev.*, 3, 75, 122.

Solubility of Solids in Vapors. BY J. M. TALMADGE. *J. Phys. Chem.*, 1, 547–554.—The author has determined at different temperatures the partial vapor-pressures of naphthalene and camphor in their saturated solutions in ether, acetone, methyl alcohol, and ethyl alcohol. He concludes from his experiments that the partial pressures are different for the different solvents, and that in the case of camphor at least the values are greater than those belonging to the pure substance at the same temperatures. However, as no check determinations are given, it is impossible to judge of the accuracy of the results. Those in the case of naphthalene in ether differ enormously from those of Benedict, previously obtained in the same laboratory. See *this Rev.*, 3, 75.

Comment on the Note of R. Franchot Entitled "Nascent Hydrogen." BY D. TOMMASI. *J. Phys. Chem.*, 1, 555.—A claim for priority.

Note. BY WILDER D. BANCROFT. *J. Phys. Chem.*, 1, 556.—Remarks on the preceding note.

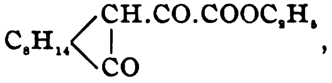
On the Speed of Reduction of Ferric Alum by Sugar. BY J. H. LONG. *J. Am. Chem. Soc.*, 19, 683–698.—The author determines the rate at which sugar reduces ferric alum by measuring the increase in electrical conductivity which the mixed solutions undergo, and comparing this with that of solutions containing the reaction-products at known concentrations. The results show that the velocity of the reaction is proportional to the amount of sugar present. The author assumes that very little sugar is used up by the reduction, and that therefore its amount remains practically constant during each series of experiments, so that the concentration of the ferric salt alone varies; and he calculates accordingly the constants of the first order. These are found to increase with the progress of the reaction, the acceleration being attributed to the free acid gradually produced by the reaction. The theoretical equation which should express this effect is not that given by the author, but the following one: $\frac{dx}{dt} = (K + K'x)(A-x)$, in which K' is a second constant representing the increase in the reaction-constant K, caused by acid of unit concentration.

Early American Chemical Societies. By H. Carrington Bolton. *J. Am. Chem. Soc.*, 19, 717–732.—The article is a description of three chemical societies founded in the United States in 1792, 1811, and 1821, respectively.

ORGANIC CHEMISTRY.

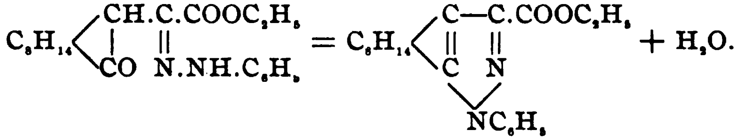
J. F. Norris, Reviewer.

The Action of Ethylic Oxalate on Camphor (II). By J. Bishop Tingle. *Am. Chem. J.*, 19, 393–410.—In order to throw some light on the structure of the 1, 3-diketones and keto-acids, the author has undertaken a further study of ethyl camphoroxalate, which was prepared by him a few years ago (*J. Chem. Soc.*, 57, 652). Although the results do not establish the correctness of the carbonyl or hydroxyl formula, they are published in order to reserve the field. Ethyl camphoroxalate,



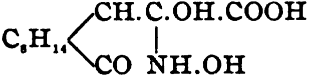
$$C_8H_{14}\left<\begin{array}{l}CH.CO.COOC_2H_5\\ |\\ CO\end{array}\right. ,$$

is best prepared by the action of sodium on a mixture of camphor and ethyl oxalate dissolved in ligroïn. It does not form a copper salt, is quickly decomposed when heated, and in presence of alkali is rapidly hydrolyzed. A hydrazone is readily formed which loses water and gives ethyl camphylphenylpyrazolecarboxylate,



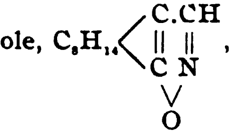
$$C_8H_{14}\left<\begin{array}{ll}CH.&C.COOC_2H_5\\ |&\|\\ CO&N.NH.C_6H_5\end{array}\right. = C_8H_{14}\left<\begin{array}{ll}C—&C.COOC_2H_5\\ \|&\|\\ C&N\\ \multicolumn{2}{c}{\diagdown\!\diagup}\\ \multicolumn{2}{c}{NC_6H_5}\end{array}\right. + H_2O.$$

From the latter ester the acid can be easily formed. Camphoroxalic acid can be boiled with concentrated alkali without decomposition. With hydroxylamine at ordinary temperature, in presence of acid sodium carbonate, it yields an addition-product, $C_{12}H_{16}O_4.NH_2OH$. The formation of this favors the hydroxyl formula for the free acid since it is scarcely to be expected that hydroxylamine would yield an addition-product with a substance containing two carbonyl groups. The formula of the compound is, consequently,



$$C_8H_{14}\left<\begin{array}{ll}CH.&C.OH.COOH\\ &|\\ CO&NH.OH\end{array}\right. .$$

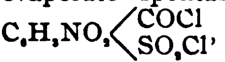
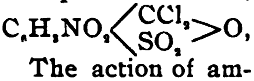
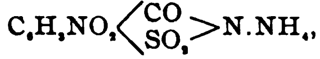
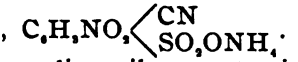
The correctness of

this view is further established by the production of camphylisoxazole,  $C_8H_{14}\left\langle\begin{array}{l}C.CH\\ \| \quad \| \\ C\ \ N\\ \ \ \backslash/ \\ \ \ \ O\end{array}\right.$, when the compound containing hydroxylamine is heated. The preparation and properties of the above bodies are described in detail.

On the Molecular Rearrangement of the Oximes by Means of Certain Metallic Salts. By William J. Comstock. *Am. Chem. J.*, **19**, 485–492.—Cuprous chloride, cuprous bromide, and antimony trichloride effect the Beckmann rearrangement of the oximes. When a cold concentrated solution of benzaldoxime in dry benzene was treated with cuprous chloride, the latter dissolved and an addition-product separated, crystallizing in colorless needles. Its formula was $(C_6H_5CH.NOH)_2CuCl$, but the antioxime was changed into its stereoisomer. When a benzene solution of the addition-product was boiled, cuprous chloride precipitated and benzamide was obtained from the filtrate. By a study of the action of cuprous chloride and bromide on benzaldoxime, cinnamaldoxime, oenanthaldoxime, acetoxime, acetophenoneoxime, and benzophenoneoxime, it was shown that the formation of addition-products of the formula, $(\text{Oxime})_2 + CuCl$ or $CuBr$, is general. The rearrangement into amide, or substituted amide, by boiling a solution of the cuprous-halide-oxime is not, however, a general reaction and when effected is not a smooth one. When the solution is boiled, there is usually, to some extent, a regeneration of aldehyde or ketone. When a saturated aqueous solution of benzaldoxime or acetoxime was treated with a solution of cupric chloride, the cuprous addition-product separated. A part of the acetoxime was split into acetone and hydroxylamine, which was oxidized to nitrous acid by the cupric chloride. Benzophenoneoxime was changed to benzanilide by antimony trichloride.

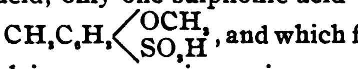
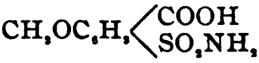
The Action of Urea and Primary Amines on Maleic Anhydrides. By Frederic L. Dunlap and Isaac Phelps. *Am. Chem. J.*, **19**, 492–496.—In a former article (*Am. Chem. J.*, **18**, 333) a method was described for the preparation of imides by the action of urea on the anhydrides of dibasic acids. It was shown that the formation was to be explained by the addition of urea to the anhydride to form an acid which, when heated, decomposed, yielding an imide, carbon dioxide, and ammonia. Maleüric acid, $HOOC.CH{=}CH.CO.NH.CO.NH_2$, has now been prepared in this way, but when heated it did not yield sufficient imide for identification. Following the method of Anschütz

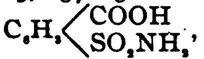
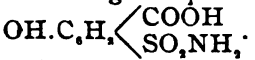
(*Ber. d. chem Ges.*, **20**, 3214) the following compounds have been prepared by the action of primary amines on maleïc anhydride: *p*- and *o*-tolylmaleämic acids $HOOC.CH{=}CH.CO.NHC_6H_4CH_3$, and *α*- and *β*-naphthylmaleämic acids, $HOOC.CH{=}CH.CO.NHC_{10}H_7$.

On the Isomeric Chlorides of *p*-nitro-*o*-Sulphobenzoic Acids. BY IRA REMSEN AND G. W. GRAY. *Am. Chem. J.*, **19**, 496–512.—The results obtained in the investigation of the chlorides of orthosulphobenzoic acids (*Am. Chem. J.*, **17**, 309, 311, 330, 347; and **18**, 791, 794, 809, 818) have led the authors to undertake a study of the corresponding chlorides of *p*-nitro-*o*-sulphobenzoic acid. With the latter acid the separation of the isomeric chlorides is easier. This is effected as follows: A chloroform solution of the mixed chlorides, prepared by the action of phosphorus pentachloride on the acid potassium salt, is allowed to evaporate spontaneously, when the symmetrical chloride,  $C_6H_3NO_2<\begin{matrix}COCl\\SO_2Cl\end{matrix}$, crystallizes in monoclinic (?) pinacoids and basal planes. When no more crystals can be obtained, the solvent is evaporated off and the resulting oil dissolved in petroleum ether, from which the unsymmetrical chloride,  $C_6H_3NO_2<\begin{matrix}CCl_2\\SO_2\end{matrix}>O$, crystallizes in fine white needles or plates. The action of ammonia is analogous to that on the chlorides of orthosulphobenzoic acid. The symmetrical yields the ammonium salt of the imide,  $C_6H_3NO_2<\begin{matrix}CO\\SO_2\end{matrix}>N.NH_4$, and the unsymmetrical the ammonium salt of a cyan acid,  $C_6H_3NO_2<\begin{matrix}CN\\SO_2ONH_4\end{matrix}$. From these ammonium salts the corresponding silver, potassium, barium, calcium, magnesium, and zinc salts were prepared. The methyl and ethyl salts of the sulphinide and the free paracyanbenzenesulphonic acid, with its chloride and amide are described.

A Study of the Action of the Nitrate and Sulphate of Paradiazotoluene on Methyl Alcohol under Various Conditions. BY WILLIAM E. CHAMBERLAIN. *Am. Chem. J.*, **19**, 531–547.—From a study of the action of methyl alcohol on the sulphate and nitrate of paradiazotoluene the conclusion is drawn that under atmospheric pressure the alkoxy reaction takes place almost entirely. With the nitrate, lowering of temperature and pressure favors the hydrogen reaction, whereas, under the same conditions, the sulphate gives a better yield of the alkoxy product. When the decompositions were effected in the presence of sodium methylate, potassium hydroxide, potassium carbonate, or zinc dust, the hydrogen reaction alone took place. When zinc oxide was used the temperature of reaction was higher and both hydrogen and the methoxy group were introduced. It follows, therefore, that the presence of alkaline substance to neutralize the acid set free and a low temperature favor the hydrogen reaction. When paradiazotoluene was decomposed with methyl alcohol some dinitroparacresol was formed. This was shown to be due to the action of the nitric acid set free upon the chief reaction-product, paracresol methyl ether, nitration and saponification taking place at the same time. This saponifying action of dilute nitric acid is unusual and took place only during nitration, as dinitrocresol ethyl ether was not saponified by long boiling with dilute nitric acid.

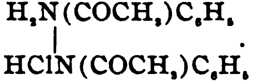
The Reaction of the Salts of Nitrodiazobenzene and the Diazobenzoic Acids with Methyl Alcohol. BY GEORGE F. WEIDA. *Am. Chem. J.*, 19, 547–561.—The following facts were established by a study of the decomposition with methyl alcohol of the diazo compounds obtained from the three nitranilines and the three aminobenzoic acids. Orthonitrodiazobenzene sulphate yields nitrobenzene as the only reaction-product that can be isolated; para- and metanitrodiazobenzene nitrates yield mostly nitrobenzene, and some nitranisol. The salts of the diazobenzoic acids all yielded as the principal product of reaction the ethereal salts of the corresponding methoxy acids; with the nitrate of the ortho acid some nitrosalicylic acid, with the sulphate of the ortho acid some methyl benzoate, and with the nitrate of the para acid some free anisic acid are obtained.

A Study of the Action of Methyl Alcohol on the Sulphate of Orthodiazotoluene. BY WILLIAM BROMWELL. *Am. Chem. J.*, 19, 561–578.—The author comes to the following conclusions from a study of the action of methyl alcohol on the sulphate of orthodiazotoluene: (1) Orthodiazotoluene sulphate is decomposed by methyl alcohol at a lower temperature than the corresponding para compound. (2) When decomposed under atmospheric pressure it gives almost exclusively the alkoxy reaction. (3) Whether decomposition takes place slowly at the temperature of the room or rapidly at a temperature near the boiling-point of the alcohol, the yield of the methoxy product is the same. (4) When orthomethoxytoluene is treated with cold concentrated sulphuric acid, only one sulphonic acid is formed, which has the formula  $CH_3C_6H_3{<}\begin{matrix}OCH_3\\SO_3H\end{matrix}$, and which forms well-characterized barium, calcium, magnesium, zinc, copper, lead, sodium, and potassium salts. (5) Methoxytoluenesulphonic acid forms a chloride and an amide which is oxidized by potassium permanganate to the acid  $CH_3OC_6H_3{<}\begin{matrix}COOH\\SO_2NH_2\end{matrix}$.

On the Action of Potassium Hydroxide on Orthomethoxysulphaminebenzoic Acid. BY CHARLES WALKER. *Am. Chem. J.*, 19, 578–581.—The methoxysulphaminebenzoic acid, $CH_3O.$  $C_6H_3\left\langle\begin{matrix}COOH\\SO_2NH_2\end{matrix}\right.$, obtained by Bromwell (preceding review) was fused with potassium hydroxide, in order to establish its constitution. This was not determined, as the sulphamine group remained intact, the resulting compound being orthoxysulphaminebenzoic acid,  $OH.C_6H_3\left\langle\begin{matrix}COOH\\SO_2NH_2\end{matrix}\right.$. Its barium, calcium, sodium, and silver salts were prepared. When heated with hydrochloric acid in a sealed tube salicylic acid was obtained.

Aluminum Alcoholates. BY H. W. HILLYER. *Am. Chem. J.*, 19, 597–603.—In a former paper the author showed (*Am. Chem. J.*, 19, 37) that aluminum alcoholates were formed by the action of aluminum on alcohols in the presence of certain anhydrous chlorides. When absolute alcohol is poured on chipped aluminum and either platinic, mercuric, or stannic chloride added, hydrogen is evolved and a rapid deposition of metal takes place with rise in temperature. A large amount of aluminum is dissolved, and a pasty reaction-product, an alcoholate, is formed. The addition of a saturated solution of hydrochloric acid in alcohol produces the same effect as the metallic chloride. The best yields are obtained when a small amount of an alcoholic solution of stannic chloride is added to the absolute alcohol containing the aluminum. Methyl alcohol acted as above, but the resulting compound could not be isolated, as it decomposed on distillation. Considering the fact of the evolution of hydrogen rather than a hydrocarbon, and the presence of aluminum in solution in a form not the chloride, the reaction can best be explained as follows: $2Al + 6CH_3OH = 2Al(OCH_3)_3 + 3H_2$. Aluminum propylate was isolated by fractional distillation and analyzed. Amyl alcohol also furnished a volatile compound, but aluminum isopropylate decomposed before distillation. The nascent hydrogen formed in this reaction furnishes a method of reduction in the entire absence of water.

Behavior of Chloral Hydrate with Ammonium Sulphide. BY JOSEPH LESINSKY AND CHARLES GUNDLICH. *Am. Chem. J.*, 19, 603–606.—A precipitate of unknown composition was formed by the action of yellow ammonium sulphide on a solution of chloral. By varying the concentrations of the solutions the color of the precipitate varies from pink to yellow and changes to brown or black on heating. The time required for precipitation decreases as the temperature increases. The authors propose to study the reaction more carefully and to use it in testing the purity of chloral hydrate.

On Halogen Addition-Products of the Anilides. BY H. L. WHEELER, BAYARD BARNES, AND J. H. PRATT. *Am. Chem. J.*, 19, 672–682.—Wheeler and Walden (*Am. Chem. J.*, 18, 85) showed that the anilides form perhalides, and it was concluded that the compounds are analogous to the perhalides of caesium and ammonium. In order to test the correctness of this view a crystallographic study of some organic and inorganic perhalides has been made. As ammonium triiodide is analogous to the perhalides of the alkali metals and shows no crystallographic analogy to the derivatives of the anilides it is concluded that it differs from the latter in structure. The view is strengthened by the fact that all of the organic perhalides are formed from salts containing two molecules of the anilide and one of the halogen acid. Perhalides from the 1 : 1 salts have not been prepared. The most probable structure of the salt $(CH_3CO.NHC_6H_5)_2.HCl$ is 

$$\begin{array}{c} H_2N(COCH_3)C_6H_5 \\ | \\ HClN(COCH_3)C_6H_5 \end{array}$$

. The perhalides are thought to be addition-products of compounds with this diammonium structure. Another striking difference between the alkali and anilide perhalides is the ease with which the latter can be obtained containing two halogens. A large number of salts and mixed perhalides of acetaniline and methyl metanitroacetanilide were prepared and studied crystallographically. It is shown incidentally that formanilide forms the salt $(HCO.NHC_6H_5)_2.HCl$, and therefore acts like a true anilide, whereas, if it had the imido structure, the hydrochloride should be a 1 : 2 salt.

On Some Malonic Acid Derivatives. BY RICHARD S. CURTISS. *Am. Chem. J.*, 19, 691–702.—Ethylanilido malonate, $C_6H_5NH.CH(COOC_2H_5)_2$, was formed when bromethyl malonate was treated with aniline. It gives a crystalline compound with hydrochloric acid gas, a sodium salt with sodium ethylate, a bromine addition-product, and reduces ammoniacal silver nitrate in the cold. When oxidized with mercuric oxide ethyldianilido malonate, $(C_6H_5NH)_2C(CO_2C_2H_5)_2$, is formed. The same compound was prepared from dibromethyl malonate and aniline. Sodium ethylate and dibromethyl malonate gave a complex mixture from which ethyl diethoxymalonate $(C_2H_5O)_2C(CO_2C_2H_5)_2$ was isolated by fractional distillation.

The Action of Nitric Acid on Triphenylmethane. BY E. S. SMITH. *Am. Chem. J.*, 19, 702.—In an attempt to make trinitrotriphenylmethane by the action of fuming nitric acid on triphenylmethane, triphenylcarbinol was obtained. It was impossible to discover the exact conditions necessary, as repetition of the work always yielded the usual nitro derivatives.

Halides and Perhalides of Pyridine. BY P. F. TROWBRIDGE AND O. C. DIEHL. *J. Am. Chem. Soc.*, 19, 558–574.—This is a continuation of a paper recently reviewed (*this Rev.*, 3, 112). Reference must be made to the original article for a description of the large number of compounds prepared.

ANALYTICAL CHEMISTRY.

ULTIMATE ANALYSIS.

H. P. TALBOT, REVIEWER.

A Modification of the Permanganate Method for the Determination of Iron. BY HAMILTON P. CADY AND ALFRED P. RUEDIGER. *J. Am. Chem. Soc.*, 19, 575–581. The reducing action of hydrochloric acid upon potassium permanganate during an iron titration may be prevented by the introduction into the solution of mercuric sulphate. The mercury ions at once tend to unite with the chlorine ions of the hydrochloric acid to form mercuric chloride, and this slightly ionized compound does not influence the permanganate. The results which the authors obtained by this modification of the permanganate process are satisfactory.

Notes on the Determination of Insoluble Phosphorus in Iron Ores. BY CHARLES T. MIXER AND HOWARD W. DUBOIS. *J. Am. Chem. Soc.*, 19, 614–619.—The authors determine the soluble phosphorus in a solution of the ore obtained by treatment with hydrochloric acid (sp. gr. 1.10). The insoluble residue is filtered, dried, and ignited for a short time at a red heat, after which the remaining phosphorus may be readily extracted by dilute acid. Analyses of the insoluble residues indicate that the phosphorus is probably in combination with alumina.

A Further Communication on the Estimation of Phosphoric Acid by Titration of the Ammonium Phosphomolybdate Precipitate with Standard Alkali. BY B. W. KILGORE. *J. Am. Chem. Soc.*, 19, 703–711.—Two main objections have been raised to the adoption of this method as an official procedure;

viz., insufficient proof of its applicability to various sorts of fertilizer material, and the difficulty in removing all the acid from the precipitate. The first objection the author meets by presenting satisfactory analyses of a wide variety of materials, made by this procedure; the supposed difficulty in washing the precipitate the author believes to be apparent rather than real.

The Exact Dilution of Liquids by Formula. By Chas. D. Howard. *J. Am. Chem. Soc.*, 19, 587.

W. H. WALKER, REVIEWER.

A New and Rapid Method for the Qualitative Separation of Iron, Aluminum, Chromium, Manganese, Zinc, Nickel, and Cobalt. By Alexander Ramsay Cushman. *Am. Chem. J.*, 19, 606–607.—This separation is based upon the behavior of the above metals with bromine water, first in the presence of strong aqueous ammonia, by which the iron, manganese, chromium, and aluminum are separated from the zinc, nickel, and cobalt, and later in the presence of an excess of potassium hydrate, which separates the iron and manganese from the aluminum and chromium. The further separation and identification of the metals is carried out in the main according to well-known procedures. No provision is made for the detection of the alkaline earth phosphates, which may be thrown down with the ammonium sulphide precipitate, and this the reviewer thinks must seriously limit the general application of the method.

The Actual Accuracy of Chemical Analyses. By F. P. Dewey. *Trans. Am. Inst. Min. Eng.*, 26, 370–379.—This paper does not consider ways and means for the increase of analytical accuracy, nor the question of what could or should be attained in this direction; it is an extensive résumé of the results exhibited in actual every day practice, and does not admit of a brief review.

Titration of Sodium Thiosulphate with Iodic Acid. By Claude F. Walker. *Am. J Sci.*, 154, 235–242.—The nature of the reaction between thiosulphuric acid and iodic acid is here studied to determine the expediency of using one acid in standard solution for the direct titration of the other. It has been stated that when sodium thiosulphate is titrated with iodic acid, the reaction takes place according to the equation:

$$6Na_2S_2O_3 + 6HIO_3 = 3Na_2S_4O_6 + 5NaIO_3 + NaI + 3H_2O.$$

Under these conditions no free iodine will be liberated until all the thiosulphate has been oxidized; the first drop of iodic acid in excess, however, will liberate iodine according to the equation:

$$5NaI + 6HIO_3 = 5NaIO_3 + 3H_2O + 3I_2,$$

thus furnishing an end-point. The results of many titrations made during this investigation are tabulated and show that the reaction does not always take place according to the above equations, but that "it is so indefinite in its nature and so dependent for its completeness on conditions of time, dilution, and mass that its direct application as a means of standardizing solutions must remain impracticable."

ASSAYING.

H. O. HOFMAN, REVIEWER.

The Assay by Prospectors for Auriferous Ores and Gravels by Means of Amalgamation and the Blow-Pipe. BY W. H. MERRITT. *Trans. Am. Inst. Min. Eng.*, **26**, 187–192.—The method recommended by the author is similar to that used by Leonard (*this Rev.*, **2**, 75); it is the one taught in the prospector-classes of the School of Mines, Kingston, Ont. The ore having been sampled down to 2 pounds is ground to pass a 40 or 60-mesh sieve, transferred to a mortar which has been charged with water, 1 ounce quicksilver, and a small amount of sodium amalgam, and rubbed with a wooden pestle. The pulp is transferred to a pan, and quicksilver concentrates and tailings are separated. The amalgam is retorted in a small cup-shaped vessel of Russia-iron, the quicksilver condensed in a hollowed-out potato, the spongy bullion from the cup mixed with lead, fused on charcoal and cupelled on a clay pipe, and the relative proportion of gold and silver estimated by the color. The balance used is one with a sliding weight weighing from 0.1 to 0.5 grain and costing $3.00. By taking as much as 2 pounds of ore for a test, the values of ores running as low as $3.60 in free-milling gold can thus be approximately determined. The paper closes with a detailed description of the apparatus required and its cost.

GEOLOGICAL AND MINERALOGICAL CHEMISTRY.

W. O. CROSBY, REVIEWER.

On the Identity of Chalcostibite (Wolfsbergite) and Guejarite, and on Chalcostibite from Huanchaca, Bolivia. BY S. L. PENFIELD AND A. FRENZEL. *Am. J. Sci.*, 154, 27–35.—This paper is the record of an elaborate chemical and crystallographic investigation based upon all the available material from various sources; and the authors have conclusively demonstrated that we have in this rare sulphide of antimony and copper but one mineral species, for which the chemically descriptive name chalcostibite has priority.

Native Iron in the Coal Measures of Missouri. By E. T. Allen. *Am. J. Sci.*, **154**, 99–104.—Three occurrences of the native iron, in as many different counties, are described. It was found in each instance in drilling through the Coal Measure sandstone, at depths of 35, 37, and 51 feet. The iron appears to occur in more or less continuous masses in the solid rock, offering great resistance to the drill, and the samples obtained consist chiefly of fragments detached from these masses in drilling, the largest weighing 45 grams. The analyses show: iron, 97.10 to 99.39; silica (originally from the sandstone), 0.31 to 1.65; phosphorus, 0.13 to 0.207; and traces of carbon. These irons are undoubtedly of terrestrial origin, and were certainly not derived from the drills. They are characterized by exceptional softness, and are attributed to the reducing action of the carbonaceous matter of the enclosing formation. The complete absence of nickel, so characteristic of meteoric irons, confirms this theory of their origin.

On Bixbyite, a New Mineral, and Notes on the Associated Topaz. By S. L. Penfield and H. W. Foote. *Am. J. Sci.*, **154**, 105–108.—The bixbyite, named after the discoverer, occurs sparingly on the border of the desert in Utah, and is attributed to fumarole action. The mineral is isometric, metallic, brilliant-black, with black streak, hardness 6 to 6.5, and specific gravity 4.945. The average of two analyses gave: SiO_2, 1.21; Al_2O_3, 2.53; Fe_2O_3, 47.98; TiO_2, 1.70; MnO, 42.05; MgO, 0.10; available oxygen, 4.38; total, 99.95. The silica and alumina are regarded as impurities. Neglecting these, two formulas are possible: R_2O_3, where R = Fe, Mn, and a little Ti; or $FeO.MnO_2$. The latter best accords with the isometric crystallization, and suggests relationship to the isometric species perofskite, $CaO.TiO_2$, and after further discussion of the analyses the conclusion is reached that the mineral really is $FeO.MnO_2$, in which small quantities of MgO and MnO are isomorphous with FeO and a little TiO_2 with MnO_2. In other words, it is a ferrous salt of manganous acid, H_2MnO_3, corresponding to braunite, $Mn.MnO_3$. The associated topaz is described crystallographically, but was not analyzed.

Note Concerning the Composition of Ilmenite. BY S. L. PENFIELD AND H. W. FOOTE. *Am. J. Sci.*, 154, 108–110.—The existence of a molecule $R^{II}O.R^{IV}O_2$ in bixbyite and perofskite brings to mind the views concerning the composition of ilmenite. One of these is that the mineral is $RO.TiO_2$ ($R = Fe$ and Mg); the other, that it is R_2O_3, or an isomorphous mixture of Fe_2O_3 and Ti_2O_3. Crystallographically, ilmenite is not intermediate between hematite and artificial Ti_2O_3, as the second formula would require; and the formula fails to account for the MgO in almost all the ilmenites that have been analyzed. Rammelsberg found 13.71 per cent. MgO in an ilmenite from Warwick, N. Y.; and this high value having been questioned, the analysis was repeated by Foote, and 15.97 per cent. MgO obtained. In the two analyses the ratio of $RO_2 : RO$ is very close to 1 : 1, thus indicating the existence of the molecule $RO.TiO_2$, where $R = Fe$ and Mg.

Igneous Rocks of the Leucite Hills and Pilot Butte, Wyoming. BY WHITMAN CROSS. *Am. J. Sci.*, 154, 115–141.—This paper is a detailed petrographic description of leucitic lavas occurring in the forms of plugs or volcanic necks and surface flows, and the author differentiates what has hitherto been regarded as one type under the names *Wyomingite*, *Orendite* and *Madupite*. Chemical analyses of these types, together with analyses of some of their constituent minerals, and of the leucitic lavas of Montana (leucitite and missourite), are given in tabular form and are remarkable for their complexity, more than twenty-five elements occurring in determinable amounts. In the discussion of the analyses it is noted that TiO_2, Cr_2O_3, BaO, and Fl are found chiefly in the phlogopite, that the sulphuric acid indicates the occurrence of noselite in the rock, and that these lavas are exceptionally rich in P_2O_5. The most striking fact revealed by the analyses is the almost identical chemical constitution of two rocks, one rich in leucite and free from sanidine (wyomingite), the other with predominant sanidine (orendite). The conclusion that the chemical composition of a magma does not alone determine whether leucite or sanidine shall be formed, but that this is controlled by conditions of consolidation, is unavoidable. From the analyses the proportions of the component minerals in each rock are computed; and after a discussion of the classification, nomenclature, and magmatic relations of these lavas, the paper concludes with an account of some interesting inclusions, and the action of the magma upon them. A rather unique, though quite incidental, mineralogical feature of these masses of lava is the occurrence in sheltered cavities and recesses of notable developments of nitre, which proves, on analysis, to be potassium nitrate in some cases and sodium nitrate in others. Although the nitric acid is most probably of organic origin, the potash and soda are supposed to have been derived directly from the adjacent volcanic rock.

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REVIEW OF AMERICAN CHEMICAL RESEARCH.

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ARTHUR A. NOYES, Editor; HENRY P. TALBOT, Associate Editor.
REVIEWERS: Analytical Chemistry, H. P. Talbot and W. H. Walker; Biological Chemistry, W. R. Whitney; Carbohydrates, G. W. Rolfe; General Chemistry, A. A. Noyes; Geological and Mineralogical Chemistry, W. O. Crosby; Inorganic Chemistry, Henry Fay; Metallurgical Chemistry and Assaying, H. O. Hofman; Organic Chemistry, J. F. Norris; Physical Chemistry, H. M. Goodwin; Sanitary Chemistry, E. H. Richards; Technical Chemistry, A. H. Gill and F. H. Thorp.

GENERAL AND PHYSICAL CHEMISTRY.

H. M. GOODWIN, REVIEWER.

Relations between the Melting-Points and the Latent Heats of Fusion of the Metals. BY JOSEPH W. RICHARDS. *J. Franklin Inst.*, 143, 379–383.—In 1893 the author pointed out that the latent heat of fusion of most metals is approximately one-third of the total heat required to heat them from —273° to their melting-points. As more recent observations have confirmed this relation, the author has collected all data bearing on this subject, and he points out the limits within which the rule apparently holds true. With the exception of bismuth, tin, gallium, and aluminum, the agreement is striking. The first two of these metals Pictet also found to be exceptions to his rule that the absolute melting-point of an element is inversely proportional to its coefficient of expansion, a, and to the cube root of its atomic volume, V; that is, $T = \frac{4.5}{a\sqrt[3]{V}}$. Aluminum, too, is known to be anomalous in many of its properties.

If the specific heat be assumed nearly constant from —273° to 100°, then the total heat contained in an atomic weight of any metal at its melting-point will be approximately $6.4T$ (Dulong and Petit's Law). Hence, according to the author's relation between latent heat and total heat, the latent heat of fusion (L) of one atomic weight of a metal will be $2.1\ T$. Combining this with Pictet's formula given above, we get $L = \frac{9.5}{a\sqrt[3]{V}}$. Using Pictet's values of $a\sqrt[3]{V}$, the agreement between the computed and observed values of L is (with the exception of aluminum) within the limits of error of the data used for comparison.

On the Second Differential Coefficients of Gibb's Functions ζ. The Vapor Tensions, Freezing- and Boiling-Points of Ternary Mixtures. By W. Lash Miller. *J. Phys. Chem.*, 1, 633–642.—The author discusses the physical interpretations which μ may have in the equations

$$\left(\frac{d\mu_1}{dm_2}\right)_{t,p,m\ m\ \ldots\ldots} = \left(\frac{d\mu_2}{dm_1}\right)_{t,p,m_2,m_3\ldots\ldots} = \text{etc.},$$

these equations being delivered by partial differentiation of Gibbs ζ function, the order of differentiation being immaterial. The phenomena with ternary mixtures, observed by McIntosch, Bancroft, and others, are shown to be in agreement with conclusions to be drawn from the above relations.

The Specific Gravities of Water Solutions of Formic Acid. By Geo. M. Richardson and Pierre Allaire. *Am. Chem. J.*, 19, 149–151.—A table is given showing the specific gravity of seventy-one formic acid solutions varying in concentration from pure acid to a 0.6 per cent. solution. The determinations were made with a picnometer at 20° C. Special attention was given to the purity of the acid.

Some Boiling-Point Determinations. By H. J. Steuber. *J. Phys. Chem.*, 1, 643–646.—The effect of the addition of sodium chloride and of sugar on the boiling-point of mixtures of alcohol and water was studied. In all cases a rise of boiling-point was observed, but this was less than that observed in water alone. The effect of the presence of alcohol was less, the greater the concentration of the solution with respect to the dissolved salt.

A New Method of Determining the Specific Heat of Liquids. By Robert L. Litch. *Phys. Rev.*, 5, 182–185.—The rise of temperature produced by a coil of wire placed in the liquid in the calorimeter is exactly compensated by the addition of a quantity m of cooler liquid of known temperature T_0 (approximately 0° C.). This is easily affected in a slightly modified form of Waterman's Calorimeter (see *this Rev.*, 3, 19). The heat H generated in the calorimeter is determined from measurements of the current, resistance, and time. The specific heat is then calculated from the equation $S = \frac{H}{m(T-T_0)}$, where $T-T_0$ is the difference between the temperature of the added liquid and that of the calorimeter. Preliminary results on water are given. These indicate a slight decrease in the specific heat between 18.8° and 21.2°. Further experiments are to be made with two calorimeters containing heating coils in series, the first calorimeter containing a liquid of known specific heat, and the second the liquid under examination. This latter method has the advantage of eliminating measurements of current and time.

Radiation in a Magnetic Field. BY A. A. MICHELSON. *Astro-Phys. J.*, 6, 48–55.—The author has examined the phenomenon discovered by Zeeman with his very sensitive interferometer, and finds that in general the effect of the magnetic field is to separate rather than broaden the lines, and that the phenomenon is not of the nature of a reversal. Thus with sodium, the lines are doubled in a field up to about 2,000 C. G. S. units, the separation being nearly proportional to the strength of field. Beyond this point the components become broadened as well as separated with increased strength of field. The broadening effect was noticeable only when the pencil of light was at right angles to the field. The red cadmium line gave similar but even more pronounced results. The green and blue cadmium lines, and the green line of mercury, on the other hand, were both separated and broadened. The hydrogen, lithium, and thallium lines were but slightly affected by the magnetic field.

Changes in the Wave-Frequencies of the Lines of Emission-Spectra of Elements, Their Dependence upon the Elements Themselves and upon the Physical Conditions under which They are Produced. BY W. J. HUMPHREYS. *Astro-Phys. J.*, 6, 169–233.—The principal results of this interesting investigation, carried out with the exceptional facilities for spectroscopic research of Prof. Rowland's laboratory, are embodied in the following summary: "1. Increase of pressure causes all isolated lines to shift towards the red end of the spectrum. 2. This shifting is directly proportional to the increase of pressure. 3. It does not depend upon the partial presence of the gas or vapor producing the lines but upon the total pressure. 4. The shift of the lines seems to be nearly or quite independent of temperature. 5. The lines of bands (at least of certain cyanogen and aluminum oxide bands), are not appreciably shifted. 6. The shifts of similar lines of a given element are proportional to the wave length of the lines themselves. 7. Different series of lines (as described by Kaysen and Runge) of a given element are shifted to different extents. When reduced to the same wave-length these shifts are to each other approximately as 1 : 2 : 4, respectively, for the principal first and second subordinate series. 8. Similar lines of an element, though not belonging to a recognized series, are shifted equally (when reduced to the same wave-length), but to a different extent than those unlike them. 9. Shifts of similar lines of differentsubstances are to each other, in such cases, as the absolute temperature of the melting-points of the elements that produced them. 10. The shifts of similar lines of different elements are to each other approximately as the products of the coefficients of linear expansion and cube roots of the atomic volumes of the respective elements (in the solid state) to which they are due. 11. Analogous or similar lines of elements belonging to the same half of a Mendelejeff group, shift proportionally to the cube roots of their respective atomic weights. 12. The lines of these substances, which in the solid form have the greatest coefficients of linear expansion, have the greatest shifts. The converse is also true. 13. The shift of similar lines is a periodic function of atomic weight, and consequently may be compared with any other property of the elements, which itself is a periodic function of their atomic weights." These conclusions are drawn from a careful study of a great many photographs of the arc spectra of the metals taken under varying conditions. The arc was enclosed in an air-tight box, the pressure in which could be varied and measured. A six-inch concave grating of twenty-one and a half feet focal length, ruled with 20,000 lines to the inch, was used. The author suggests several hypotheses of a kinetic nature to account for the shifting of the lines observed.

On the Conditions Required for Attaining Maximum Accuracy in the Determination of Specific Heat by the Method of Mixtures. BY F. L. O. WADSWORTH. *Am. J. Sci.*, 154, 265–283.—This author gives a precision discussion of the formula for calculating specific heat by the method of mixtures, with special reference to the cooling correction as determined by the methods of Rumford, Jamin, Regnault, and Holman. This is followed by the description of a method by which the correction for radiation is wholly eliminated. It is essentially a perfection of Rumford's method, in which the temperature of the surroundings is so determined and adjusted before the experiment that the maximum temperature reached is that which the calorimeter would have attained had no loss by radiation occurred. Two preliminary series of measurements on the rate of cooling are necessary for the determination of the proper initial temperature of the surroundings. A modification of Regnault's apparatus is also described, by which the hot body is transferred in a little car sliding upon rails from the heater to the calorimeter, where it is dropped in by means of an ingeniously contrived trap. A convenient method of filling an ice calorimeter with water is described, and the advantage is pointed out of placing the calorimeter in a bottle containing partially frozen distilled water.

TECHNICAL CHEMISTRY.

F. H. THORP, REVIEWER.

System of Tanning in India. BY K. E. TALATI. *Leather Manufacturer*, **8**, 43.—This short article describes the crude process as carried on near Bombay. The hides are "limed," but not "bated." Ten days or more are required for liming, unhairing, and fleshing the skins. The tanning proper is done with a decoction of *acacia auriculata*, or turwar bark. The extract, at 12° Bk., is made with cold water, and the skins lie in the liquor ten days. They are then treated with stronger liquor for twelve days more. After removal from the bark solution, the hides are steeped four days in myrabolans liquor, made with hot water. They are then wrung and oiled with sesame oil or ground-nut oil; and are dried in the air.

New Method of Chrome Tanning. BY WM. M. NORRIS. *Leather Manufacturer*, **8**, 38–39.—The article is an abstract by the inventor of U. S. Patent No. 588,874. Metallic zinc is added to the reducing bath of sodium thiosulphate or sodium bisulphite. The free acid in the bath attacks the zinc and the hydrogen liberated converts the sulphurous acid into hyposulphurous acid, a more powerful reducing body.

Producing Fancy Leathers. BY H. C. STANDAGE. *Leather Manufacturer*, **8**, 22–23, 44–45.—This is a general description of the process of making Morocco and imitation Morocco leathers.

The Influence of the Gravity of Glycerine on the Yield of Nitroglycerine. BY W. E. GARRIGUES. *Proc. Eng. Soc. Western Pa.*, 13, 265.—The author wished to determine whether variations of two or three units in the third decimal place of the specific gravity of glycerine, has any effect on the yield of nitroglycerine, when calculated from the actual quantity of glycerine nitrated. A series of experiments on four samples of glycerine of 1.2623, 1.2613, 1.2600, and 1.2572 sp. gr., respectively, where the percentage of glycerine varies from 99 to 97, show that the small quantity of water present has no practical effect on the yield of nitroglycerine. All samples were nitrated with the same acid mixture and under exactly similar circumstances. He concludes that with commercial glycerine above 1.257 sp. gr. or 97 per cent. glycerine, the value is exactly according to its percentage of strength. The details of the experiment are fully explained. The author also demonstrates that the yield may be influenced by the method of separating the acid and nitroglycerine. If separated by settling only, the yield is less than if the charge is "drowned" in an excess of water. But since the latter method gives a milky product, he intimates that the apparent increase may be due to absorbed water. The method of determining the specific gravity of glycerine by the use of the picnometer is also explained.

Softening Agents for the Production of Asphalt Cement for Paving and other Purposes. Chemical Constitution of Residuums and Malthas, and Its Relation to Water Action. Solubility of the Asphalt Hydrocarbons in Heavy Petroleum Oil. BY CLIFFORD RICHARDSON. *Municipal Eng.*, 12, 343; 13, 1, 67.—These papers form a series of popular articles, containing some tables of the properties and composition of asphalts, malthas, and residuums.

How to Analyze Clay. BY HOLDEN M. ASHBY. *Brick*, 7, 57, 113, 148.—This is a series of illustrated articles on the methods of analysis employed for clay. The articles are copyrighted and appear to be abstracts from notes prepared by the author for the use of students or others desiring instruction in chemical analysis as applied to clay alone.

Nitrosylized Blast Furnace Slag as an Addition to Hydraulic Cement. BY A. D. ELBERS. *Eng. Min. J.*, 63, 661, 364, 454. —To make "nitrosylized" slag, finely ground slag is moistened with weak nitric acid, water is added after the acid has become neutralized, and the leached mass is dried. Each 100 pounds of slag requires one-half pound of 60 per cent. (N_2O_5) acid and 30 pounds of water. The object is the removal of calcium sulphide from the slag. The "nitrosyl" (NO ?) set free by the action of the acid on the slag, is absorbed by the ferrous silicate in the slag, thus, it is supposed, rendering its silica more "disposed to sever its connection with the ferrous oxide and to become gelatinous when acted upon by the dissolved lime." It also prevents the formation of ferric hydrate, since the iron is rendered soluble and is washed away, while gelatinous silica deposits on the surface of the slag particles. Briquettes of slag, which had been treated thus, were tested in various ways; the author concludes, from the results, that ordinary and inferior Portland cements may be mixed with such slag, without diminishing their strength, but only small quantities should be added to high grade cements.

Composition and Formation of Tank Residues in Electrolytic Copper Refineries. BY EDWARD KELLER. *J. Am. Chem. Soc.*, 19, 778–782.

The Chemistry of the Pottery Industry. BY KARL LANGENBECK. *J. Franklin Inst.*, 143, 321.—The article represents a lecture given before the Institute. A few analyses are tabulated.

W. R. WHITNEY, REVIEWER.

The Manufacture and Applications of Lactic Acid. BY A. A. CLAFLIN. *Am. J. Pharm.*, 69, 599–604.—The paper contains extracts from the note-book of a chemist engaged in the manufacture of lactic acid. The process is the fermentation of glucose by the bacillus acidi lacti, which the author, by inadvertently omitting the prefix micro, describes as "averaging in length 2–2.5 millimeters." A saccharine solution containing 7.5 to 11 per cent. saccharine matter, of which 10–15 per cent. is advantageously cane sugar, is employed. The solution should also contain albuminoid matter and preferably a quantity equal to about 8 per cent. of the saccharine matter. After sterilization the solution is impregnated with the bacillus at 45°, below which temperature the fermentation takes place. Milk of lime is added from time to time to counteract the increasing acidity of the solution. To obtain the purest lactic acid, the calcium lactate is crystallized from the solution after the glucose is almost completely fermented, and the acid is obtained by distilling the salt with sulphuric acid.

Formaldehyde. BY O. I. AFFELDER. *Proc. Eng. Soc. Western Pa.*, 13, 350–362.—This paper is divided into three parts entitled preparation, reactions, and determination. In the first part modifications of the method of Tollens are described. The methyl alcohol vaporized with air was passed through a heated iron pipe instead of glass, as described by Tollens. A table is given showing the effect of varying the rate of the air current which passes through the methyl alcohol. The maximum yield of aldehyde occurred when 0.7 cubic foot of air passed per hour. The effect of various temperatures of the iron pipe was also studied. It was found that below 250° C. little or no aldehyde is formed. At 350° a maximum is reached. A description of lamps to be used in forming aldehyde by combustion of the alcohol, with or without the use of gas, is given. The article is concluded with a very complete collection of the qualitative tests and methods of quantitative analysis of formaldehyde.

A. H. GILL, REVIEWER.

Certain Phenomena of Gas Explosions. BY W. H. BIRCHMORE. *Am. Gas Light J.*, 67, 563–565.—The article deals with the explosion or combustion of mixtures of air and hydrogen, air and detonating gas, and air and acetylene. The experiments took place in a tube instead of a bulb; and in the case of the acetylene they are instructive as showing how the Paris explosion may have taken place. The article is written in a popular style and gives no experimental data.

Anhydrous Ammonia for Ice Machines. By H. Faurot. *Am. Gas Light J.*, 66, 728.—The author recommends the testing of the liquid ammonia used for refrigeration. The common gaseous impurities are air and the constituents of illuminating gas. These can be detected by discharging the ammonia into water and analyzing the insoluble gases. The liquid impurities are water and oils; these are detected by allowing 50 cc. of the liquid to evaporate in a tube with a narrow graduated bottom, the volume of the residual liquid being noted. The boiling-point of commercial ammonia should not be higher than —28.6° F.

G. W. Rolfe, Reviewer.

Spontaneous Combustion of Molasses. By J. T. Crawley. *J. Am. Chem. Soc.*, 19, 538–542.—An account is given of an investigation into a curious case of spontaneous combustion of a tank of molasses at an Hawaiian sugar-house. The author found that fully eighty per cent. of the sugars in the molasses, besides most of the gums and mucilages, had been destroyed. He can give no satisfactory explanation of the cause of combustion, but is inclined to believe that the decomposition of the non-sugars may have much to do with it.

On the Use of Silico-Fluorides in Sugar Refining. By Walter Mills. *La. Planter and Sugar Mfgr.*, 19, 188–189.—The author attributes the failure of hydrofluosilicic acid as a refining agent to its inverting action; and he recommends the use of the ammonium salt, which is free from this drawback and which, moreover, precipitates lime salts as well as the alkalies. The experiments of the author show that 34.8 per cent. of the ash is removed by this agent.

BIOLOGICAL CHEMISTRY.

W. R. Whitney, Reviewer.

The Action of Certain Bodies on the Digestive Ferments. By Frank D. Simons. *J. Am. Chem. Soc.*, 19, 744–754.—The bodies referred to are the common coloring matters, flavoring extracts, and preservatives. Among the most interesting results may be mentioned the discovery that peptic digestion is greatly retarded by picric acid, tropaeolin 000, and metanil yellow, less so by salicylic acid and oil of wintergreen, and that pancreatic digestion is retarded by Bismarck brown, cinnamon, and formol.

The Amount and Properties of the Proteids of the Maize Kernel. By Thomas B. Osborne. *J. Am. Chem. Soc.*, 19, 525-532.—This is a continuation of the work of Chittenden and Osborne on the maize kernel. The article contains descriptions and analyses of the four fractions into which they had divided the proteid matter.

The Caffein Compounds of Kola. By J. W. T. Knox and A. B. Prescott. *Pharm. Rev.*, 15, 172–176; 191-196.--The recent literature of oak tannins is considered at length, after which a description of the methods used in preparing the free kola tannin, and of some of its chemical properties, is given. The second part of the paper contains the results of analyses of the kola tannin, its bromine and acetyl derivatives, and its several anhydrides. The methods of preparation of these compounds and their properties are given.

The Tannin of Castanopsis. By Henry Trimble. *Am. J. Pharm.*, 69, 406–408.—This relates to the nature of the tannin in the bark of a group of trees intermediate between oaks and chestnuts in character. The tannin of the American Quercus densiflora and the Castanopsis chrysophylla of this group were shown to be identical with the oak tannin. As the chestnut tannin differs from these, and is identical with galltannin, the above intermediate group partakes of the nature of oaks. A table giving the analyses of ten of these barks accompanies the article.

Aralia Nudicaulis. By W. C. Alpers and B. J. Murray. *Am J. Pharm.*, 69, 534–543.—This paper is a treatise on the wild sarsaparilla. Qualitative tests for tannin, sugar, alkaloids, etc., are described. Alkaloids and glucosides were not found. Tannin, starch, a volatile oil, and a resin were found. The results of a proximate quantitative analysis of the drug are given.

The Important Constituents of Taraxacum Root. By L. E. Sayre. *Am. J. Pharm.*, 69, 543–546.—This portion of the author's continued work on Taraxacum is devoted to the bitter principle and to the analysis of the drug and of its ash.

The Tannin of Ceriops Candolleana. By Henry Trimble. *Am. J. Pharm.*, 69, 505–506.—This tree is common in India, being a small evergreen of the mangrove genus. Its bark is unusually rich in tannin, one dried sample containing 31.56 per cent. The tannin was shown to belong to the same class as the oak bark tannins.

Some Products of the Tuberculosis Bacillus. By E. A. de Schweinitz and M. Dorset. *J. Am. Chem. Soc.*, 10, 782–785. —From bacillus cultures the authors have isolated a crystalline compound of melting-point 161°–164°. It is an acid soluble in ether, alcohol, and in water, and its analysis corresponds nearly to that of teraconic acid ($C_7H_{10}O_4$). It is evidently that product of the tuberculosis germ which produces the necrosis peculiar to these bacilli.

On the Presence of Amylolytic Ferment and Its Zymogen in the Salivary Gland. By C. W. Latimer and J. W. Warren. *J. Exptal. Medicine*, 2, 465–273.—Chloroform water and sodium fluoride solutions were used to extract the salivary glands of dogs, cats, rats, mice, oxen, sheep, and opossums. The extract was tested for amylolytic power; it was then acidified with acetic acid, and after ten minutes neutralized. The resulting solution was tested with starch paste for the zymogen. Many of the extracts contained the active ferment (ptyalin), many also the ptyalinogen, but no classification seems possible. No quantitative work was attempted.

On the Presence of Milk-Curdling Ferment (Pexin) in the Gastric Mucous Membrane of Vertebrates. By J. W. Warren. *J. Exptal. Medicine*, 2, 476–492.—With chloroform water extracts the presence of a milk-curdling ferment in the stomachs of many vertebrates has been shown. This the writer calls pexin and its forerunner pexinogen. Active ferments were found by him in the extract from the ox and calf only. Fifty-three stomachs from thirteen different vertebrates gave pexinogen, which was made active as a ferment by acidification of the extract by acetic acid and subsequent neutralization.

Note on the Influence of "Peptone" on the Clotting of Milk by Rennet. By F. S. Locke. *J. Exptal. Medicine*, 2, 492-499.—The previous work on this subject has been done with peptones having an alkaline reaction. To this alkalinity the author thinks the action of the peptone, in delaying the coagulation by rennet, should be ascribed, although attempts to obtain a peptone which did not cause this delay were futile.

Algae and Antiseptics. By R. H. True. *Pharm. Rev.*, 15, 152–153.—This is practically a continuation of work done by Kahlenberg and True on the connection between the toxic action of acids, bases, and salts, and the condition of electrolytic dissociation of the agent. In this case the author has undertaken a study of the effects of acids and phenols upon the common spirogyra, and has determined the maximum dilutions fatal to this algae. With hydrochloric and sulphuric acids this dilution was found to be 800 and 1600 liters per gram-molecule, respectively, which seems to confirm the opinion that the toxic action of the acids is to be accredited to the hydrogen ions. With hydrochinone the toxic power was greatly increased by the spontaneous alteration in this phenol in its dilute solutions. This is to be further investigated.

G. W. ROLFE, REVIEWER.

The Distribution of Galactan. BY J. B. LINDSEY AND E. B. HOLLAND. *Mass. Agr. Coll. Ann. Rep.*, 34, 192–196.—The authors describe their method, which is that perfected by Tollens and others, based on the estimation of the derived mucic acid, and publish a large number of results, which show that galactan, while extensively distributed, is present in considerable quantity only in the leguminous plants. The greatest percentage was found in clover and lupin seeds, the amount in the latter exceeding 14 per cent.

SANITARY CHEMISTRY.

E. H. RICHARDS, REVIEWER.

The Filtration of Water. BY EDMUND B. WESTON. *Municipal Eng.*, 13, 199–207.—The author considers the "American system of filtration" to be "mechanical filtration aided by the application of chemicals," in distinction from sand filtration, a process which was imported from Europe. He estimates the cost of the latter to be considerably more than that of the former, and questions the expediency of incurring this extra cost to obtain the increase of 1.5 per cent. of efficiency in the removal of bacteria which he concedes to the best European practice.

Mechanical Filtration of the Public Water Supply of Lorain, Ohio. BY C. O. PROBST. *Ohio Sanitary Bull.*, 1, 100–120.—This report gives the conditions under which were made the tests of the Jewell filters, in purifying the water of Lake Erie, which is contaminated at the intake by the water from Black River. The results show that the use of 2.5 grams of alum per gallon and a rate of 100,000,000 gallons per acre per 24 hours appears to affect a sufficient purification.

Milk: Its Value as a Food and Studies which Suggest a Different Method of Sale. BY E. B. VOORHEES AND C. B. LANE. *N. J. Agr. Sta. Bull.*, 123, 1–19.—The authors give the results of a year's study of the composition of the milk of a herd and of individual cows as affected by food and external conditions, and show that uniformity can be maintained, and suggest that consumers should be educated to consider that a definite relation between price and food value can be established.

The Composition of Prepared Cereal Foods. BY E. E. SLOSSON. *Wyoming Expt. Sta. Bull.*, 33, 71–84.—Analyses of twenty-one of the common "Breakfast Foods" are given. The results with thirteen preparations of wheat are shown in the following table:

	Fat. Per cent.	Protein. Per cent.	Calories per gram.	Cost.
Maximum	3.72	16.60	4689	15.8
Minimum	1.20	9.37	3993	4.3
Average	1.85	12.44	4215	9.5

The author concludes that "there is more variation in price than in composition." He might have added that the cost bore no relation to the food value or the palatability. In the six samples of preparations from oats, there is even less variation in composition, but more in price. Oatmeal, in bulk, is bought for 2.5 cents per pound, while 12.8 cents is paid for a brand very slightly richer. Another supposed advantage of the package foods is taken away by the author's statement "that the claims for quick cooking are generally fallacious."

Soy Beans as Food for Man. BY C. F. LANGWORTHY. *U. S. Dept. Agr. Farmers' Bull.*, 58, 20–23.—In addition to a table giving nineteen selected analyses of the soy bean grown in different countries, the author describes ten modes of preparing it for food, mostly by fermentation, and gives the composition of the products. It is claimed that the soy bean contains no starch, and that when the cellulose is broken down by bacterial action, the nitrogen is well assimilated; it is also stated that these products replace meat in the Japanese dietary.

Human Food Investigations. BY HARRY SNYDER. *Univ. Minn. Agr. Expt. Sta. Bull.*, 54, 37–90.—The author summarizes valuable work on the character and composition of the nitrogenous constituents of wheat as affecting the light porous loaf of the bread made from the different varieties, and shows that the prolonged fermentation of the dough causes certain losses in both the starchy and nitrogenous constituents. He does not, however, discuss the most important corollary: Is not the bread so much improved in flavor as to offset this small loss? Digestibility experiments were made with bread from whole wheat, bakers' flour, and patent spring wheat flour. The results showed that all were well assimilated. In the case of potatoes, the starch is the most perfectly digested, while the nitrogenous portion is less available than in most vegetable substances. Experiments were also made in regard to the loss of food value by the different ways of cooking. Potatoes lose a large per cent. of the nitrogen when pared and soaked in cold water before cooking ; but, as might have been predicted, very little of the starch is lost (except in the parings, which, however, may amount to 30 per cent. by weight, as has been determined repeatedly in the New England Kitchen). As the author has shown that the nitrogen is of small moment in the potato, one is puzzled to discover why so much stress is laid on this loss. The escape of the mineral salts is a more serious matter. The losses incurred in the cooking of carrots and cabbages are next considered, and shown to be very large, amounting to some 30 per cent. of the total food value, and the conclusion is that only by the use of the water in which the vegetables are cooked can all this value be recovered. The rest of the *Bulletin* gives in a concise form a summary of the main facts upon which the "*Rational Feeding of Men*" may be based. Tables of composition of food substances are reprinted from the *U. S. Dept. Agr. Bulletins.*

The Value of a Bacteriological Examination of Water from a Sanitary Point of View. By E. K. Dunham. *J. Am. Chem. Soc.*, 19, 591–605.—The author discusses both the methods of determining the presence of pathogenic forms of bacteria in potable water, and the interpretation of the results. He concludes that the method proposed is capable of giving information of value, especially when supplemented by the determination of the presence or absence of sufficient organic matter to furnish food for the continued growth of the organisms.

W. R. WHITNEY, REVIEWER.

The Constitution of Milk with Special Reference to Cheese Production. By S. M. Babcock. *Wis. Agr. Expt. Sta. Bull.*, 61, 1–21.—This is a comprehensive treatment of the subject, but it contains little that is really new.

Tainted or Defective Milks: Their Causes and Methods of Prevention. By H. L. Russel. *Wis. Agr. Expt. Sta. Bull.*, 62, 1–27.—The sources of contamination are considered, the effects on the value of the milk for various purposes are pointed out, and methods for preventing or remedying the evils are suggested.

Composition of Full Cream Cheese. By Wm. Frear. *Pa. State College, School Agr.*, *Bull.* 2, 1–16.—This paper summarizes experiments made in several states to determine the average composition of full cream cheese, and the variation in composition likely to arise from differences in the quality of the milk from which it is made. Briefly, the results are as follows: Green cheese of less than 32 per cent. fat is seldom produced from average factory milk; a green cheese loses about 5 per cent. in weight during one month's curing; and a reduction in the fat-content of the cheese is not likely to occur from the minor accidental variations in processes of manufacture or in differences of composition of unskimmed factory milk.

AGRICULTURAL CHEMISTRY.

W. R. WHITNEY, REVIEWER.

On the Influence of Vegetable Mould on the Nitrogenous Content of Oats. BY H. W. WILEY. *J. Am. Chem. Soc.*, 19, 605–614.—The author concludes from the investigation of the effects of various soils on the composition of oats grown in them, that humus soils greatly increase the nitrogen content of the cereal, this increase being chiefly in amid nitrogen. Three forms of fertilizers employed on humus soils caused about an equal increase in the quantity and alteration of the quality of the crop.

Physical Effects of Various Salts and Fertilizer Ingredients upon a Soil as Modifying the Factors which Control its Supply of Moisture. BY J. L. BEESON. *J. Am. Chem. Soc.*, 19, 620–649.—This article contains descriptions of apparatus and methods employed in studying, under varying conditions of composition, etc., the rate of percolation of water through soils, its evaporation from them, their water-holding capacity, and their rate of saturation.

The Composition of Humus. BY HARRY SNYDER. *J. Am. Chem. Soc.*, 19, 738–744.—Analyses of different kinds of humus made by the decomposition in soils of various kinds of organic matter are given. The results make evident the fact that the chemical similarity between the different varieties is no greater than a consideration of their derivations would warrant; and they make necessary the indefinite postponement of an accurate chemical classification of these different forms of humus.

A Study of Alfalfa and Some Other Hays. BY W. P. HEADDON. *Col. Agr. Expt. Sta. Bull.*, 39, 1–34.—This contains comparative analyses of alfalfa crops of different years and different cuttings of the same year, together with their relative digestibilities, as measured by acid pepsin solutions. Clover, pea vines, and upland hays are also subjected to the same methods of investigation. The results are well summarized on the concluding page, and the paper must be recognized as an important contribution to our knowledge of fodders. The author's remarks concerning criticisms adverse to the class of investigations of which this paper is a good example, may have considerable significance in Colorado; but the value of scientific study in the comparatively fertile field of agricultural chemistry is elsewhere rapidly receiving the appreciation due to it.

Burdock as a Vegetable. BY INAZO NITOBE. *Am. J. Pharm.*, **69**, 416–420.—The author discusses the use of the luppa or burdock root as an article of food and gives a table in which its composition is compared with that of other vegetables. In Japan, in 1888, about 36,000 tons of this root were produced for home consumption.

F. H. THORP, REVIEWER.

Electrical Method of Determining the Moisture Content of Arable Soils. Electrical Method of Determining the Temperature of Soil. Electrical Method of Determining the Soluble Salt Content of Soil. *U. S. Dept. Agr.* (*Division of Soils*) *Bulls.*, **6**, **7**, **8**.

Fertilizers. *Hatch Expt. Sta. Bull.*, **48**; *Purdue Univ. Special Bull., May, 1897; N. H. Agr. Expt. Sta. Bull.*, **43**; *N. Y. Agr. Expt. Sta. Rep., 1895*, 156–229; *N. Y. Agr. Expt. Sta. Bull.*, **116**; *N. C. Agr. Expt. Sta. Bull.*, **136**.

Some Notes Concerning the Nitrogen Content of Soils and Humus. BY E. FULMER. *Wash. Agr. Expt. Sta. Bull.*, **23**. —This bulletin contains determinations of nitrogen, phosphoric acid, potash, lime, iron oxide, and organic matter, in 53 soil samples.

G. W. ROLFE, REVIEWER.

Sugar Beets. BY W. W. COOKE AND WILLIAM P. HEADDON. *Col. State Agr. Coll. Bull.*, **36**, 1–23.

A Review of Oregon Sugar Beets. BY G. W. SHAW. *Ore. Agr. Expt. Sta. Bull.*, **44**, 1–49.—These bulletins are excellent examples of the work which many of the official experiment stations are doing out of deference to a generally awakened interest in the possibilities of beet sugar manufactured in this country. The experimental results of the investigations on the production and yield of the sugar beet in Colorado and Oregon are, as far as they go, favorable to the industry. Both reports give much practical information of a general nature as to cultivation. The Oregon report also goes into the manufacture and cost of production of the sugar, and will doubtless be of value in correcting the fallacious ideas so prevalent as to the conditions requisite for success from a business standpoint.

ANALYTICAL CHEMISTRY.

PROXIMATE ANALYSIS.

A. H. GILL, REVIEWER.

The Detection of Foreign Fats in Lard and Butter. BY C. B. COCHRAN. *J. Am. Chem. Soc.*, 19, 796–799.—Two cubic centimeters of the melted fat are introduced into 22 cc. of fusel oil contained in a glass-stoppered graduate, and the mixture is warmed to about 40° C. and allowed to cool slowly to 16° or 17° C. for two or three hours. A crystalline deposit forms, which is filtered off, recrystallized from ether, and examined microscopically. The method is capable of detecting five per cent. of beef fat. The amount of deposit which is formed and the melting-point of the sample may furnish a basis of estimation of the quantity of admixture.

Volatile Oils and Their Assay. BY E. KREMERS. *Pharm. Rev.*, 15, 196–198.—The article is an introductory one dealing with the changes produced in the oils upon standing and by distillation.

Notes on Several Fatty Oils. BY F. A. SIEKER. *Pharm. Rev.*, 15, 112–113.—The oils described are those of the Saw palmetto, pumpkin seed, and croton oil. Saw palmetto oil is soluble in alcohol as well as ether and petroleum ether; it has a specific gravity of 0.9138 at 15° C., and a cold test of 14°. The iodine value is 42–43, and the saponification numbers are 212.5 to 217; it does not solidify when subjected to elaidin test. Pumpkin seed oil is of a reddish-yellow color, soluble in ether, petroleum ether, and carbon disulphide, but insoluble in alcohol. Its specific gravity is 0.9231 at 15° C; its iodine value, 118–119; and its saponification number 195. It is not solidified by the elaidin test. Croton oil is of a yellow color and is soluble in the usual solvents. Its specific gravity at 15° C. is 0.9445; its iodine value, 107–108; and its saponification number, 192–196.

The Chemistry of Food Adulteration. BY HENRY LEFFMANN. *J. Franklin Inst.*, 144, 133–137.—This paper is an abstract of an address on the methods of expressing analytical results in food analysis.

G. W. ROLFE, REVIEWER.

The Exact Estimation of Total Carbohydrates in Acid Hydrolyzed Starch Products. BY GEO. W. ROLFE AND W. A. FAXON. *J. Am. Chem. Soc.*, 19, 698–703.—The authors compute by a graphical method from the specific gravity factors for hydrolyzed starch products of all possible specific rotatory powers. The actual specific gravity factors of sixteen hydrolyzed starch samples were obtained by evaporation to dryness, by method of Lobray de Bruyn and Van Laent. They were found as a whole to agree closely with the calculated values. A formula is given by which the total carbohydrates in any solution of the kind can be quickly estimated, when the specific rotatory power, obtained by the factor 386, is known.

The Phloroglucin Method for the Estimation of Pentsoans. By J. B. LINDSEY AND E. B. HOLLAND. *Mass. Agr. College Ann. Rep.*, 34, 197–199.—The authors describe the method devised by Councler and perfected by Kruger and Tollens, and give six determinations of seeds and fodders, together with six parallel determinations by the usual phenyl hydrazin method. The results are concordant, and the authors recommend the phloroglucin process on account of its greater simplicity.

F. H. THORP, REVIEWER.

A Comparison of the Methods for Determination of Glycerol. With Notes on the Standardizing of Sodium Thio-Sulphate. BY W. E. GARRIGUES. *Proc. Eng. Soc. Western Pa.*, 13, 271.—Minute directions are given for the three standard methods of analyzing spent soap lyes, with certain modifications, by the author. The processes examined were (*a*) Benedikt and Zsigmondy's oxidation process, with alkaline permanganate; (*b*) Benedikt and Cantor's acetin process; (*c*) Hehner's oxidation process with acid bichromate solution. The author concludes that crude glycerol is best determined by the acetin process, and soap lyes by the bichromate method. The proper conditions must be observed in standardizing the thiosulphate and in determining chromic acid; the process recommended is as follows: 25 cc. of chromic acid solution are mixed with 10 cc. of a ten per cent. potassium iodide solution and five cc. of strong hydrochloric acid. Let the mixture stand ten minutes and then dilute with 150 cc. of water, and titrate the iodine, stoppering and shaking violently between the addition of the last few drops of thiosulphate, to dissolve any iodine in the precipitated iodide of starch. This is essential to accurate work. There is no benefit to be obtained in using lead acetate with lyes or crude glycerine, since the sulphuric acid is sufficient to clarify them. But in candle glycerine, a little lead may be used to precipitate organic matter.

Asphalt Examination. BY H. ENDEMANN. *Municipal Eng.*, 13, 6.—This is a short article on a method of analysis proposed by the author for the separation of petrolene and asphaltene. A number of analyses are given; and a method of calculating the amounts of asphalts of different quality, which must be combined to produce a standard grade is fully explained.

Determination of Potash and Phosphoric Acid in Fodders. By H. W. Wiley. *J. Am. Chem. Soc.*, 19, 320–322.—This article describes an improvement on the usual method, whereby time is saved.

W. R. Whitney, Reviewer.

The Rapid Estimation of Uric Acid in Urine. By E. H. Bartley. *J. Am. Chem. Soc.*, 19, 649–656.—After a comprehensive review of many methods employed for uric acid determination, the author describes one of his own. This consists of a titration with silver nitrate solution in the warmed urine after the addition of ammonium and magnesia mixture. The end-point is determined by testing a drop of the solution for silver by sodium sulphide, from time to time, during the titration. Comparative results obtained by Ludwig's and by the author's method are given.

APPARATUS.

A. H. Gill, Reviewer.

A Recent Assay Balance. By L. S. Austin. *Proc. Col. Sci. Soc.*, *1897*, 1–6.—The article describes what would seem to be an unusually delicate balance.

Some New Forms of Apparatus. By A. E. Knorr. *J. Am. Chem. Soc.*, 19, 817.

An Electrical Laboratory Stove. By M. D. Sohon. *J. Am. Chem. Soc.*, 19, 790.

Mechanical Arrangement for Fat Extraction Apparatus. By G. J. Volckening. *J. Am. Chem. Soc.*, 19, 735.

Method of Drying Sensitive Organic Substances. By. C. C. Parsons. *J. Am. Chem. Soc.*, 19, 388.

A New Form of Condenser for the Distillation of Liquids having Low Boiling-Points. By E. E. Ewell. *J. Am. Chem. Soc.*, 19, 398.

A New Apparatus for Sulphur Determinations in Iron and Steel, and a Useful Form of Wash-Bottle. By R. K. Meade. *J. Am. Chem. Soc.*, 19, 581.

A Simple Fat Extractor. BY V. J. HALL. *J. Am. Chem. Soc.*, 19, 586.

An Apparatus for Collecting Samples of Water. BY GEORGE C. WHIPPLE. *Eng. Record*, 35, 515.—The apparatus is designed to collect water from considerable depths. For the method of operation reference must be made to the original article.

A Simple and Efficient Boiling-Point Apparatus for Use with Low- and with High-Boiling Solvents. BY HARRY C. JONES. *Am. Chem. J.*, 19, 581–597.—The author discusses the various forms of apparatus in use, and suggests a modification of Hite's apparatus, in which the condensed solvent is not returned directly into the boiling solution. The apparatus consists of a tube about one-fourth filled with glass beads, on which rests a platinum cylinder. The thermometer is immersed in the solvent inside the cylinder, which serves to separate the condensed solvent and boiling solution. The results obtained seem to be very satisfactory.

METALLURGICAL CHEMISTRY.

H. O. HOFMANN, REVIEWER.

Ferric Sulphate in Mine Waters and Its Action upon Metals. BY L. J. W. JONES. *Proc. Col. Sci. Soc.*, June 15, 1897.—The author analyzed a muddy mine water, which strongly corroded the pumps and other iron parts. The filtered mud gave: Fe_2O_3, 53.57; Al_2O_3, 2.87; SiO_2, 10.85; SO_3, 11.46; H_2O, 21.14. The filtered water in 1,000 parts: SiO_2, 0.043800; NaCl, 0.013450; Na_2SO_4, 0.311720; K_2SO_4, 0.155480; $Al_2(SO_4)_3$, 0.019787; $ZnSO_4$, 0.122440; $MnSO_4$, 0.427140; $MgSO_4$, 0.467460; $CaSO_4$, 0.636290; $Fe_2(SO_4)_3$, 0.603360; $FeSO_4$, 0.009337; $CuSO_4$, 0.1918010; total, 3.002065. Free sulphuric acid was absent; the corrosive action on iron was due, in part, to cupric sulphate, and the solvent power for copper to ferric sulphate. As a result of a number of experiments, bronze pipe was used in the mine and this has stood for over two years.

Composition and Formation of Tank Residues in Electrolytic Refineries. BY E. KELLER. *J. Am. Chem. Soc.*, 19, 778–782.—The author compares the composition of anode coppers with that of the tank residues obtained during a given time at one of the leading electrolytic copper refineries of the country, and draws deductions as to the degree of concentration of silver (gold) in the residue, and the amount of the original contents of the anodes which went into solution and remained in the residue. He also calls attention to the fact that selenium is present in Montana coppers to a much greater extent than is generally believed.

Practical Workings of Chlorination. By T. G. Taylor. *Min. Sci. Press*, 75, 48.—The article is a description of the work done at the Champion mine, Nevada City, Cal.

Apparatus for Extracting Gold and Silver from Ores by the Cyanide Process. By A. S. Cooper. *Min. Sci. Press*, 74, 542–543.—A sheet-iron conical drum, closed at both ends and having spiral blades, revolves on a horizontal axis. It receives ores and solutions at the larger end and discharges them at the smaller one.

Notes on the Action of Potassium Zinc Cyanide Solutions on Gold. By W. J. Sharwood. *Eng. Min. J.*, 64, 396, 426, 460, 461.—The author gives a summary of what has been published on the subject with all the necessary references, discusses the value of the different equations proposed from a thermochemical point of view, and describes in detail his own experiments, embodying over two hundred and fifty observations, to which the reader is referred for details. The conclusions arrived at are: (1) The gold-dissolving power of a solution of potassium zinc cyanide increases rapidly with increased excess of oxygen, presence of oxygen being the most essential condition. (2) It increases somewhat with strength of solution, but this effect is small. (3) It increases with a rise of temperature. (4) Gold dissolves in the solutions without forming any precipitate at first, but after a certain proportion of gold has dissolved, a white precipitate begins and continues to form, gradually coating the metal and retarding further action. The amount of precipitate is not proportional to that of the gold dissolved, being relatively less when the amount of solvent is large; it consists of a somewhat variable mixture of cyanide and oxide of zinc. (5) The solvent action of the double cyanide solution is less than that of a solution of simple potassium cyanide containing the same amount, or half the amount, of cyanogen in equal volumes. (6) It is increased by addition of caustic alkali, other conditions remaining the same, and the increase is greatest in solutions to which oxygen has the freest access. (7) The considerable increase in solvent power observed when caustic potash is added (always provided that oxygen is accessible), coupled with the superior effect of free potassium cyanide, is good evidence that some free potassium cyanide is formed upon such addition, and, therefore, that in dilute solutions (such as 0.3 to 0.6 per cent. or 0.80 to 0.40 gram molecule per liter) potassium zinc cyanide is partially decomposed by caustic alkali, in accordance with the principles of chemical equilibrium between substances in solution.

Cyanide Mill Solutions. BY PH. ARGALL. *Eng. Min. J.*, 64, 393.—This note is a correction of a typographical error in a previous paper (*this Rev.*, 3, 139). In the table there given, in place of: KCy 0.501, 0.451, 0.535, 0.410; read KCy 0.501, 0.491, 0.505, 0.505.

The Edison Concentrating Works. BY C. KIRCKHOFF. *Iron Age*, No. 18, 60, 1–8.—The larger part of this paper is an illustrated description of the magnetic concentration plant of Edison at the Ogden Mines, N. J. The magnetite concentrates are converted into briquettes containing: Fe 67–68, SiO_2 2–3, Al_2O_3 0.4–0.8, Mn 0.05–0.10, CaO, MgO, S traces, P 0.028–0.033, resinous binder 0.78, H_2O none. In trial runs made in the blast furnace of the Crane Works, Catasauqua, Pa., the normal product of 100–110 tons of pig was increased to 138.5 tons. This was due to the richness of the ore, which, however, caused not only an increased output of pig but a decrease in the amount of limestone required and a larger number of charges. It was also found that the fuel consumption was lowered. The following analyses give the character of the pig produced:

Date.	Percentage briquette on charge.	Tons of pig produced.	Si.	P.	S.	Mn.
Jan. 5	25	104	2.750	0.830	0.018	0.500
" 6	37.5	124.5	2.620	0.740	0.018	0.350
" 7	50	138.5	2.572	0.580	0.015	0.200
" 8	75	119	1.844	0.264	0.022	0.200
" 9	100	138.5	1.712	0.147	0.038	0.185

The Value of Physical Tests. BY S. S. KNIGHT. *Am. Manufacturer*, 61, 585–586.—The paper is a strong plea that chemical work in the iron foundry shall be on the same footing with physical testing, which is so frequently made the sole standard. In his arguments the author brings forward several facts of general interest. He shows by analyses and physical tests that the adage "the shrinkage in iron varies inversely as the silicon" is absolutely wrong, the fact being that it varies directly as the sulphur, manganese, combined carbon and titanium and inversely as the silicon and phosphorus. How absolutely necessary chemical work is in a foundry is illustrated by an interesting set of determinations, showing that the first tap of a day from the cupola was uniformly softer than that of any others made later during the day; *e. g.*: Silicon in metal from first tap was 2.739, 2.891, 2.624 per cent., and from the fourth tap, 2.102, 2.007, 1.992 per cent.

A Preliminary Thermo-Chemical Study of Iron and Steel. By E. D. Campbell and F. Thompson. *J. Am. Chem. Soc.*, 19, 754–766.—This paper comprises the results obtained by the authors in trying to determine whether carbon was the sole cause for the variations in the heat of solution of steels subjected to different heat treatments. They summarize the work done by Troost and Hautefeuille in 1875, and Osmond in 1885, and give the results of their own work, which is brought together in four tables representing the influence on the heat of solution of chemical composition, annealing, quenching, tempering, and reheating, and of reheating on the tensile strength of cold-drawn wire.

Semi-Steel. By C. Kirckhoff. *Iron Age*, No. 3, 60, 13.—The basis of this metal is a low-carbon steel to which are added special irons which make the product homogeneous, solid, strong, and tough. It has twice the strength and elasticity of cast iron, can be used in seventy-five per cent. of the work for which steel castings are commonly used, and costs about half the price.

ASSAYING.

H. O. Hofman, Reviewer.

A Modified Method of Fine Silver Assay. By A. E. Knorr. *J. Am. Chem. Soc.*, 19, 814–816.—The author has combined the Gay-Lussac and Volhard methods of assaying fine silver, by precipitating the bulk of the silver with a standard salt solution in the usual way and finishing the assay with potassium sulphocyanate, of which 1 cc. will precipitate 1 mg. silver. As indicator he uses 5 cc. of a solution of ferric ammonic alum.

Assaying Gold and Silver. By J. B. Eckfeldt. *Min. Sci. Press*, 75, 4, 29, 49.—These articles give an outline of the modes of procedure at the United States Mint at Philadelphia.

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REVIEW

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REVIEW OF AMERICAN CHEMICAL RESEARCH.

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ARTHUR A. NOYES, Editor; HENRY P. TALBOT, Associate Editor.
REVIEWERS: Analytical Chemistry, H. P. Talbot and W. H. Walker; Biological Chemistry, W. R. Whitney; Carbohydrates, G. W. Rolfe; General Chemistry, A. A. Noyes; Geological and Mineralogical Chemistry, W. O. Crosby; Inorganic Chemistry, Henry Fay; Metallurgical Chemistry and Assaying, H. O. Hofman; Organic Chemistry, J. F. Norris; Physical Chemistry, H. M. Goodwin; Sanitary Chemistry, E. H. Richards; Technical Chemistry, A. H. Gill and F. H. Thorp.

INORGANIC CHEMISTRY.

HENRY FAY, REVIEWER.

A New Explosive Compound Formed by the Action of Liquid Ammonia upon Iodine. BY HAMILTON P. CADY. *Kan. Univ. Quart.*, 6, 71–75.—When 25–30 cc. of liquid ammonia are added to 4–5 grams of iodine in a vacuum-jacketed tube protected from moisture, the iodine is dissolved, forming a dark, opaque liquid which changes to olive-green and deposits a dark-green, crystalline precipitate. This substance, dried over sulphuric acid, dissolves in ether, alcohol, and chloroform; but it is insoluble in dilute acids, and is decomposed by them, generally with explosive violence. It is instantly decomposed by strong acids. Potassium iodide solution dissolves the crystals, and they are decomposed and dissolved by hydrogen sulphide, sulphurous acid and potassium hydroxide. The composition of the substance, as shown by analysis, agrees well with the formula HN_3I; and the formation of the compound is supposed to take place according to the equation: $11NH_3+9I = HN_3I+8NH_4I$.

Note on Extemporaneous Chlorine Water. BY F. B. POWER. *Pharm. Rev.*, 15, 108.—The author criticises the statement made by Griggi that chlorine can be prepared according to the equation:

$$2H_2C_2O_4+PbO_2+CaCl_2 = CaC_2O_4+PbC_2O_4+2H_2O+Cl_2.$$

It was shown that what was taken for chlorine was probably ozone; and that while the oxalic acid was mostly oxidized to carbon dioxide, practically all of the calcium chloride was unacted upon.

The Action of Carbon Dioxide upon Sodium Aluminate and the Formation of Basic Aluminium Carbonate. BY WILLIAM

C. DAY. *Am. Chem. J.*, 19, 707–728.—The author has analyzed a series of preparations made by precipitating sodium aluminate by carbon dioxide. The sodium aluminate was prepared from Connetable phosphate rock, by treating it with sodium carbonate and quicklime, which leaves all iron compounds and calcium phosphate undissolved. Before working with the samples prepared, a commercial product, "Alumina soluble in acids," was analyzed, and found to contain 26.38 per cent. CO_2, and 21.30 per cent. Na_2O. Some of the original substance was then washed with water until no alkali could be detected by litmus or phenol-phthalein. The dried residue from the washing effervesced with acid, and gave on analysis 17.35 per cent. CO_2, and 12.22 per cent. Na_2O, amounts corresponding closely to that required for sodium bicarbonate. Several preparations were then made and washed with hot water until apparently free from alkali; they were then dried on the water-bath and analyzed; but it was found that all portions contained sodium oxide and carbon dioxide. This dried sample showed alkali on washing, and continued to show it after apparently washed free from it a second time. Preparations washed with cold water by decantation until apparently free from alkali always showed it on analysis, but gave off more after drying and washing again. In two samples it was possible to wash the sodium out until only 0.23 and 0.34 per cent. remained; and in the same preparations there were left respectively 9.06 and 3.99 per cent. of carbon dioxide, which is more than that needed for the formation of sodium bicarbonate, indicating that a basic aluminum carbonate of varying composition might exist.

On the Chloronitrides of Phosphorus. (II). BY H. N. STOKES. *Am. Chem. J.*, 19, 782–796.—In a previous paper (this *Rev.*, 3, 4), the author described the phosphonitrilic chlorides having the composition $P_3N_3Cl_6$ and $P_4N_4Cl_8$, and their corresponding acids. This paper is a continuation of the work describing the polymers of the same series. The following table shows the additional members which have been isolated, together with their properties:

	Melting-point.	Boiling-point.	
		13 mm.	760 mm.
Triphosphonitrilic chloride, $(PNCl_2)_3$	114°	127°	256.5°
Tetraphosphonitrilic chloride, $(PNCl_2)_4$	123.5°	188°	328.5°
Pentaphosphonitrilic chloride, $(PNCl_2)_5$	40.5–41°	223–224.3°	Polymerizes
Hexaphosphonitrilic chloride, $(PNCl_2)_6$	91°	261–263°	Polymerizes
Heptaphosphonitrilic chloride, $(PNCl_2)_7$	liquid at --18°	289–294°	Polymerizes
Polyphosphonitrilic chloride, $(PNCl_2)_x$	Below red heat.	Depolymerizes on distillation.	

There was also obtained a liquid residue of the same empirical composition of a *mean* molecular weight corresponding nearly to $(PNCl_2)_{11}$; but it has not yet been prepared in a pure condition. The method that gives the best results in the preparation of these compounds is to heat a mixture of four parts of dry phosphorus pentachloride with one part of ammonium chloride. As the mixture liberates hydrochloric acid, it is necessary to open the tube occasionally to relieve the pressure; and this is best accomplished by heating to 150° C., allowing to cool to 100°., and opening the tubes while in the furnace. This process is repeated several times, each time heating 1°–2° higher. After most of the hydrochloric acid has been removed in this way, the tube can be safely heated to 200° C. The contents of the tube are then distilled off, and the distillate is found to consist of a crystalline mass impregnated with a yellow oil, amounting to 95 per cent. of the theoretical quantity of phosphonitrilic chlorides, of a small amount of phosphorus pentachloride, of some chloronitride of the composition $P_6N_7Cl_9$, and of traces of an unknown compound. The melted distillate is poured into cold water to remove phosphorus pentachloride; and it is then heated for about two hours. The product is then fractionated up to 200° C. at 13–15 mm., using an Anschütz flask. The distillate at this temperature consists of about 70 per cent. $P_3N_3Cl_6$ and $P_4N_4Cl_8$; the residue of $P_5N_5Cl_{10}$ and the higher members. If the distillate is not desired, it is best to take advantage of the peculiar properties of the substance and polymerize it to the compound $(PNCl_2)_x$ which can in turn be depolymerized, giving the different lower members of the series. The residue of $P_5N_5Cl_{10}$ and higher members is fractionated above 200° C. Polymerization often takes place during the heating, as is indicated by the frothing; but this may be overcome by heating with water and removing the small amount of oil formed, and again continuing the fractionation. It has not been found advisable to heat above 370°, as polymerization takes place rapidly at that temperature. Pentaphosphonitrilic chloride at its melting-point is soluble in all proportions of benzene, ether, carbon bisulphide, and gasoline; but it cannot be crystallized from any of them. It shows a decided tendency to superfusion. The next two members of the series are soluble in benzene, ether, carbon bisulphide and gasoline; hexaphosphonitrilic chloride possessing a strong crystallizing power. When any of the lower members are heated polyphosphonitrilic chloride is formed slowly at 250° C., and rapidly at 350° C. As the change is reversible, complete transformation cannot be effected; but it reaches 90 per cent. The pure chloride is colorless, transparent, and elastic; it is insoluble in all neutral solvents; but it readily absorbs benzene, swelling to a rubber-like compound of many times its own volume. Hot water slowly dissolves it with decomposition; it swells, gelatinizes, and finally dissolves in ammonia. Depolymerization begins at 350° C., and this change is rapid below a red heat.

On the Solubility of Ammonia in Water at Temperatures below 0°. By J. W. Mallet. *Am. Chem. J.*, 19, 804–809.—The author has extended the determination of the solubility of ammonia made by Roscoe and Ditmar from 0° to —40° C. Strong aqueous ammonia was placed in a burette-like tube surrounded by a freezing mixture, and gaseous ammonia, previously cooled by being passed through tubes placed in freezing mixtures, was passed into the already strong solution. The temperature was recorded by means of a standardized alcohol thermometer. Measured portions were drawn off, beginning at —40° C. at intervals of 10° into water cooled to 0° and titrated with sulphuric acid. The solution of enough ammonia to form ammonium hydroxide was not attended with any apparent change of behavior; and continuous liquefaction went on smoothly to the lowest temperature reached, without separation of any solid product. The table expresses the amount of ammonia dissolved in one gram of water at a pressure of 743–744.4 mm.:

°C.	Grams.	°C.	Grams.
—3.9	0.947	—25	2.554
—10	1.115	—30	2.781
—20	1.768	—40	2.946

The amount dissolved at —3.9° C. corresponds almost exactly to that calculated for ammonium hydroxide.

The Action of Nitric Acid on Aluminum and the Formation of Aluminum Nitrate. By Thomas B. Stillman. *J. Am. Chem. Soc.*, 19, 711–717.—The author shows that aluminum in the form of coarse turnings is readily acted upon by nitric acid, hot or cold, of specific gravity 1.15 or 1.45, the weaker acid acting the more rapidly. The reaction is retarded if the aluminum is in the form of plates, the retardation being very slight with cold acid, but considerable if the acid is warm. The solutions deposited crystals of the composition $Al(NO_3)_3.9H_2O$.

Notes on Selenium and Tellurium. By Edward Kellar. *J. Am. Chem. Soc.*, 19, 771–778.—It is shown that ferric hydroxide carries down both selenium and tellurium, the amount needed for the precipitation of the former element being much greater than for the latter. To obtain both elements quantitatively in precipitating from hydrochloric acid solutions, it is necessary to have the acidity of the solution between definite limits, 30–50 per cent. Figures are given for the partial precipitation of both elements, showing that the amount of precipitate varies with the time, temperature, and the acidity of the solutions. There is complete precipitation of tellurium when the solution contains 0.5 per cent. acid, but then none of the selenium is precipitated. When the acidity has reached 80 per cent., all of the selenium, but no tellurium, is precipitated. The reducing action of ferrous sulphate is almost identical with that of sulphurous acid. In precipitating copper solutions containing selenium with hydrogen sulphide, some of the latter is always carried down, probably in combination with copper as selenide.

Further Study on the Influence of Heat Treatment and Carbon upon the Solubility of Phosphorus in Steel. By E. D. Campbell and S. C. Babcock. *J. Am. Chem. Soc.*, 19, 786–790.—This is a continuation of a previous paper (this *Rev.*, 3, 2) greater care having been taken here to measure temperatures by means of a Le Chatelier pyrometer. The general results reached are: that phosphorus may exist in at least two forms in steel; that carbon and the different heat treatment, annealing and quenching, considerably affect the solubility of the phosphorus in acid mercuric chloride solution, the amount going into solution apparently increasing with increase of the temperature at which the metal is quenched, and also with the percentage of carbon.

Contribution to the Chemistry of Didymium. By L. M. Dennis and E. M. Chamot. *J. Am. Chem. Soc.*, 19, 799–809. —The mixture of earths used in this work was extracted from monazite sand from Brazil. The sand was decomposed by sulphuric acid, and the rare earths separated from the other elements in the usual way. Cerium was separated from the didymium group by the chlorine process in apparatus specially devised for the purpose. The oxalates were then decomposed by heat and converted into nitrates, their solution being treated with an excess of potassium sulphate for the purpose of removing the yttrium group. The double sulphates were then dissolved in dilute ammonium acetate, converted into the hydroxides and then into nitrates. Fractionation of the double ammonium nitrates by the methods of Welsbach and Bettendorf did not yield satisfactory results; and it was found that the best results were obtained by slow spontaneous evaporation. In this way there was more rapid separation of neodidymium from praseodidymium. A large portion of lanthanum salts was separated in the first fractions, disappearing for a time, and again appearing in later fractions. It was found that the presence of the lanthanum salts aided much in the splitting of the two constituents of didymium. Detailed directions are given for the method giving the most satisfactory results.

A Study of the Mixed Halides and Halo-Thiocyanates of Lead. BY CHARLES H. HERTY AND J. R. BOGGS. *J. Am. Chem. Soc.*, **19**, 820–824.—Lead chloride and lead bromide form isomorphous mixtures in all proportions, while lead iodide with lead chloride or bromide forms mixed crystals with the latter in excess. Lead thiocyanate forms true compounds with both lead chloride and lead bromide, but with lead iodide forms neither mixed crystals nor a chemical compound.

On the Existence of Orthosilicic Acid. BY T. H. NORTON AND D. M. ROTH. *J. Am. Chem. Soc.*, **19**, 832–834.—Silicic acid obtained by passing silicon tetrafluoride into water, was thrown on a cloth filter, washed quickly with ether or benzene, dried by pressure between folds of filter paper, and analyzed. The results obtained agree well with the formula H_4SiO_4. The substance thus obtained readily loses water.

The Solubility of Stannous Iodide in Water and in Solutions of Hydriodic Acid. BY S. W. YOUNG. *J. Am. Chem. Soc.*, **19**, 845–851.—Portions of saturated solutions of stannous iodide in water and in hydriodic acid protected from the air by a layer of oil, were drawn off at different temperatures, weighed and titrated with iodine solution. The results are normal with water, but the solubility in hydriodic acid decreases until the solution contains 6–7 per cent. of acid, and thereafter increases. When the concentration has reached 25 per cent. of hydriodic acid there is a marked increase in the solubility with decreasing temperature (see next abstract). Tables and curves are given expressing the solubility values.

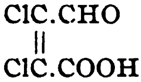
On Iodostannous Acid. BY S. W. YOUNG. *J. Am. Chem. Soc.*, **19**, 851–859.—When the solution of stannous iodide in hydriodic acid, containing 25 per cent. acid, is cooled in ice water, light yellow needles crystallize out. Unsuccessful attempts were made to dry these crystals in hydrogen and in hydriodic acid at different temperatures, but decomposition always resulted. Their composition was established indirectly by analyzing for total stannous iodide, iodine, and free hydriodic acid, before and after cooling to separate the crystals. The difference in the amounts found represented what had left the solution to form the crystals, which were found to have the composition represented by the formula $SnI_2.HI$.

On the Reactions between Mercury and Concentrated Sulphuric Acid. By Charles Baskerville and F. W. Miller. *J. Am. Chem. Soc.*, **19**, 873–877.—When mercury is in excess almost pure mercurous sulphate and sulphur dioxide are formed, with no evidence of hydrogen as hydrogen sulphide; but when the sulphuric acid is in excess, there is formed at 150° a compound having the composition $Hg_2SO_4.HgSO_4$. With increasing temperature there was corresponding decrease in the amount of mercurous sulphate formed. This method for preparing sulphur dioxide is not convenient on account of the volatility of mercury.

ORGANIC CHEMISTRY.

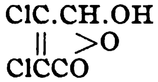
J. F. Norris, Reviewer.

1. **On the Oximes of Mucophenoxychloric and Mucophenoxybromic Acids.** By Henry B. Hill and John A. Widtsoe. 2. **On the Action of Aluminic Chloride and Benzol upon Mucochloryl Chloride, Mucobromyl Bromide, and the Corresponding Acids.** By Henry B. Hill and Frederick L. Dunlap. *Am. Chem. J.*, **19**, 627–650.—Hill and Cornelison (*Am. Chem. J.*, **16**, 188, 277) found that mucochloric and mucobromic acids yielded with hydroxylamine oximes of normal character, while the bromanhydrides of these acids could easily be converted by reduction into the corresponding substituted crotonolactones. The former reaction indicated the presence of an aldehyde group, while the latter was evidence of a different structure. The two views are expressed by the following formulæ:



$$\begin{array}{l} \text{ClC.CHO} \\ \;\| \\ \text{ClC.COOH} \end{array}$$

(1)

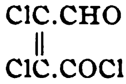


$$\begin{array}{l} \text{ClC.CH.OH} \\ \;\| \;\; >\text{O} \\ \text{ClCCO} \end{array}$$

(2)

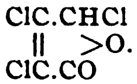
The action of hydroxylamine on the methyl esters of mucochloric and mucobromic acids was studied in order to see if they, too, exhibited tautomerism. They did not form an oxime and accordingly were derivatives of formula (2). The present paper contains the results of a similar investigation of mucophenoxybromic and mucophenoxychloric acids and their esters. The methyl esters readily gave oximes identical with those prepared by the action of methyl iodide on the silver salts of the oximes of the acids. The marked difference in behavior which was shown by mucochloric and mucobromic acids and their esters disappears as soon as one atom of halogen is replaced by the phenoxy group. No explanation of this is offered. In the course of the investigation the following compounds were prepared and are described fully : the silver salt and methyl and ethyl esters of mucophenoxybromoxime, methylmucophenoxybromate, mucophenoxybromoxime anhydride, phenoxybrommaleïnimide and its silver salt, and the corresponding derivatives of mucophenoxychloric acid.

2. The conversion of mucochloric and mucobromic acids, through their bromanhydrides, into substituted crotonolactones, finds its simplest explanation in the assumption that these acids themselves are oxylactones (formula 2). This conclusion has been reached by the study of a reaction of an entirely different character. The two possible structures for the chloranhydrides of mucochloric acid are :



$$\begin{array}{c}\mathrm{ClC.CHO}\\ \| \\ \mathrm{ClC.COCl}\end{array}$$

and



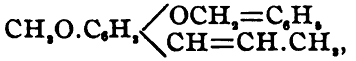
$$\begin{array}{l}\mathrm{ClC.CHCl}\\ \quad\| \quad >\mathrm{O}.\\ \mathrm{ClC.CO}\end{array}$$

The first should give an aldehyde ketone while the second should yield dichlordiphenylcrotonic acid when treated with benzene and aluminum chloride. Both the acid and its chloranhydride when so treated gave dichlordiphenylcrotonic acid. With mucobromic acid the analogous acid containing bromine was formed. The structure of the latter was determined by conversion through oxidation into diphenylacetic acid. The following substances are described : mucochloryl chloride ; dichlordiphenylcrotonic acid and its barium and calcium salts ; diphenylbutyric acid, formed by the reduction of diphenyldichlorcrotonic acid, and its silver salt; dibromdiphenylcrotonic acid, its barium, calcium, and silver salts, and methyl ester ; and diphenylbromallylene dibromide, formed by the action of bromine on the product resulting from the decomposition of dibromdiphenylcrotonic acid in alkaline solution.

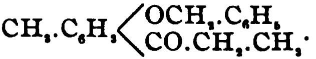
On the Absorption of Oxygen by Tetrabromfurfuran. By Henry A. Torrey. *Am. Chem. J.*, 19, 668–672.—Hill and Hartshorn (*Ber. d. chem. Ges.*, 18, 448) found that α-dibromfurfuran was readily oxidized to maleïc acid upon exposure to the air, but that tetrabromfurfuran, which also contains two bromine atoms in the α-position, under ordinary conditions, was not affected. It has lately been discovered that exposure to direct sunlight causes a similar decomposition of tetrabromfurfuran. This change is most readily effected when the substance is exposed to strong sunlight in an atmosphere of dry oxygen. In 7 or 8 hours the increase in weight is equivalent to about 85 per cent. of one molecular weight of oxygen. The main product was shown to be dibrommaleyl bromide.

On Certain Derivatives of Brommaleic and Chlormaleic Acid-Aldehydes. BY HENRY B. HILL AND EUGENE T. ALLEN. *Am. Chem. J.*, 19, 650–667.—Limpricht (*Ann. Chem.*, 165, 287) obtained with great difficulty, by the action of aqueous bromine upon pyromucic acid, a compound which he considered to be the half aldehyde of fumaric acid, as it yielded the latter when oxidized with silver oxide. Since the authors were unable to isolate the compound from the viscous reaction-product, it was treated with hydroxylamine hydrochlorate and an aldoxime was obtained in small quantity, which contained bromine. By using pyromucic acid and bromine in the molecular proportions of one to three the yield of the oxime was greatly increased. From the brommaleïc acid-aldoxime so prepared the barium, lead, and silver salts and methyl ester were formed. The anhydride was made by the action of concentrated hydrochloric acid and by dissolving the oxime in concentrated sulphuric acid and precipitating with water. In the same way the anhydrides of mucochlor- and mucobromoxime were prepared. Brommaleïnimide could not be formed by heating directly the brommaleïc acid-aldoxime, but was obtained in small yield by sublimation from the carbonaceous residue left when the anhydride was cautiously heated. Hydrobromic acid reacts with brommaleïc acid-aldoxime forming brommaleïc acid, or, on long standing, dibromsuccinic acid. By dissolving the oxime in a mixture of acetic acid and acetic anhydride and saturating with hydrochloric acid gas, bromchlorsuccinic acid was obtained. By the action of hydrochloric acid, hydrobromic acid, and bromine on the methyl ester of brommaleïc acid-aldoxime direct addition-products were formed. Tribromsuccinic acid-aldoxime was changed into dibromacroleïnoxime by warming with water at 40°. It was impossible to isolate dibromacroleïn from its oxime, but by boiling the latter with dilute hydrochloric acid a solution was obtained, which showed the reactions of aldehydes and from which an α-β-dibromacrylic acid was obtained in small yield by oxidizing with silver oxide. As the substituted acrylic acid did not melt at the melting-point of dibromacrylic acid obtained from tribromsuccinic acid, it was probably an isomer of it. Chlormaleïc acid-aldoxime was prepared by the action of chlorine on pyromucic acid and was studied in the same way that the corresponding bromine compound was.

Derivatives of Eugenol. BY F. J. POND AND F. T. BEERS. *J. Am. Chem. Soc.*, 19, 825–832.—Benzyl eugenol, prepared by the action of benzyl chloride on the sodium salt of eugenol, was transformed into its isomer isobenzyl eugenol,

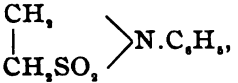
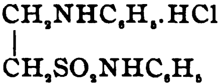
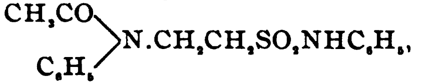


$$CH_3O.C_6H_3\left\langle\begin{matrix}OCH_2=C_6H_5\\CH=CH.CH_3,\end{matrix}\right.$$

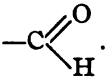
by boiling with alcoholic potassium hydroxide. This yielded a dibrom addition-product, which was converted by sodium methylate into the ketone  $CH_3.C_6H_3\left\langle\begin{array}{l}OCH_2.C_6H_5\\CO.CH_2.CH_3\end{array}\right.$. The oxime of the latter was also prepared.

Derivatives of Benzenesulphonic Acid. By T. H. Norton. *J. Am. Chem. Soc.*, 19, 835–838.—A detailed description is given of the preparation and properties of benzenesulphonbromide and the sodium, potassium, ammonium, and lithium salts of benzenesulphonic acid.

On a Soluble Compound of Hydrastine with Monocalcium Phosphate. By T. H. Norton and H. E. Newman.. *J. Am. Chem. Soc.*, 19 ,838–840.—A large excess of hydrastine was agitated with a saturated solution of monocalcium phosphate. At the end of 80 hours the solution was filtered and evaporated to dryness, when an amorphous residue was left, which was soluble in about ten parts of water. The analyses corresponded to the formula $2Ca(H_2PO_4)_2.3C_{21}H_{21}NO_6$.

Aliphatic Sulphonic Acids. By Elmer P. Kohler. *Am. Chem. J.*, 19, 728–752.—The work described is the result of an effort to find general methods for the preparation of unsaturated aliphatic sulphonic acids, and particularly of isomeric sulphonic acids analogous to fumaric and maleïc acids. A large number of sulphonic acids were studied with reference to their behavior with phosphorus pentachloride and the behavior of the resulting chlorides toward water. As it was found that the main product of the action of water on the chloride of a (1, 2)-disulphonic acid was an unsaturated acid, (1, 2)-ethanedisulphonic acid was carefully studied. The work now published is the result of this part of the investigation. Sodium ethanedisulphonate was prepared by boiling ethylene bromide with a saturated solution of sodium sulphite. The author's method gives 95 per cent. of the theoretical yield. From this a nearly quantitative yield of the chloride was obtained by the action of phosphorus pentachloride. As it melted sharply, the possibility of the formation of isomers was excluded. From the close analogy of (1,2)-ethanedisulphonic acid, succinic acid, and orthosulphobenzoic acid, it seemed probable that the former, like the latter, would yield both a symmetrical and an unsymmetrical chloride. But one, however, was obtained, although the conditions under which it was prepared were varied. As the same compound was also formed by the action of carbonyl chloride on ethanedisulphonic acid, it has probably the symmetrical structure $(CH_2SO_2Cl)_2$. The chloride reacts with water very slowly at 0°. At 100° it decomposes rapidly, forming sulphur dioxide, hydrochloric acid, and ethylenesulphonic acid, according to the following equation: $(CH_2SO_2Cl)_2 + H_2O = CH_2{=}CH.SO_3H + SO_2 + 2HCl$. The yield of unsaturated acid is about 90 per cent. of the theory. A small amount of ethanedisulphonic acid is formed at the same time. Alcohols produce a similar decomposition, the yield of unsaturated acid decreasing as the number of carbon atoms in the alcohol increase; *e. g.*, methyl, propyl, and amyl alcohols, give 73, 56, and 51 per cent. respectively. Ammonia does not give an amide, but ammonium chloride, ammonium sulphite, ammonium ethanedisulphonate, and anhydrotaurine. With aniline anhydrophenyltaurine,  $\left.\begin{matrix}CH_2\\ |\\ CH_2SO_2\end{matrix}\right\rangle N.C_6H_5$, and the hydrochlorate of anilidoethanesulphone anilide,  $\begin{matrix}CH_2NHC_6H_5.HCl\\ |\\ CH_2SO_2NHC_6H_5\end{matrix}$, were obtained. From the latter the free base was isolated, and from this the monoacetyl derivative was made, which had the structure  $\left.\begin{matrix}CH_3CO\\ \\ C_6H_5\end{matrix}\right\rangle N.CH_2CH_2SO_2NHC_6H_5$, as it was soluble in alkali. Since the amide of ethanedisulphonic acid could not be prepared by the usual reactions, an effort was made to get it by the action of acetamide on the chloride. The reaction did not take place in the manner expected. The hydrochlorate of acetamide, ammonium ethanedisulphonate, and ammonium chlorethanesulphonate were obtained. The chloride, dissolved in glacial acetic acid, was decomposed by sodium acetate, the products being, as before, ethylene sulphonic acid and ethane disulphonic acid. With zinc dust a 53 per cent. yield of (1,2)-ethanedisulphinic acid was obtained. As a result of the work the conclusion is drawn that the best way to prepare unsaturated aliphatic sulphonic acids is to decompose with water the chlorides of polysulphonic acids, which have the sulphonic acid residues in the (1,2)-positions with respect to each other.

Some New Derivatives of Diacetyl. By HARRY F. KELLER AND PHILIP MAAS. *J. Franklin Inst.*, 144, 379–385.—As hydrogen peroxide converts diacetyl quantitatively into acetic acid, its action was studied on dibrom and tetrabromdiacetyl in order to determine their structure. If the oxidizing agent acts in the same way with these substances and they have symmetrical structures, the first would give two molecules of bromacetic acid and the second two molecules of dibromacetic acid. Bromacetic acid was obtained from the former, but the latter yielded pentabromacetone. Diacetyl and hydrocyanic acid unite quantitatively to form a dicyanohydrin, which is readily converted into dimethylracemic acid. Attempts to prepare a monocyanohydrin of diacetyl were unsuccessful, however. When diacetyl and hydrocyanic acid were brought together in molecular proportions, there was evidence of a reaction, but no compound could be isolated. The resulting viscous liquid was treated with hydrochloric acid under different conditions, in order to saponify it, but no acid was obtained. Dibromdiacetyl and hydrocyanic acid united, forming a dicyanohydrin. Dichlordiacetyl was prepared by the action of chlorine on diacetyl dissolved in chloroform.

On Diacyl Anilides. By H. L. Wheeler, T. E. Smith and C. H. Warren. *Am. Chem. J.*, **19**, 757–766.—The fact that formanilide differs in many of its physical properties from other anilides has been offered as evidence that it is not a true anilide, and consequently does not contain the formyl group  $-\mathrm{C}\genfrac{}{}{0pt}{}{\nearrow \mathrm{O}}{\searrow \mathrm{H}}$. As the formyl group is present in the diacyl anilides, a crystallographic study was made of formylbenzenesulphanilide and its homologues containing the acetyl and propionyl groups in order to discover if any marked differences in physical structure existed. It was found that the anilides containing acetyl and propionyl show close crystallographic analogy, both being monoclinic, hemimorphic, and pyroelectric, their axes and the angle β being similar, whereas, formylbenzenesulphanilide is orthorhombic. It follows, therefore, that the departure in physical properties of formanilide from those of its homologues can not be taken as evidence against its being a true anilide. In addition to the compounds mentioned, the following are described: *n*-butyrylbenzenesulphanilide, benzoylbenzenesulphanilide, benzoylbenzenesulph-α-(and β)-naphthalide. The crystallography of benzoylbenzenesulphanilide and formanilide is also given. The latter crystallizes in the monoclinic system, whereas acetanilide is orthorhombic.

Note on a Somewhat Remarkable Case of the Rapid Polymerization of Chloral. By J. W. Mallet. *Am. Chem. J.*, **19**, 809–810.—A sample of anhydrous chloral, which had been kept in a sealed tube for over a year, exploded with considerable violence while undisturbed in a room at about 20° C. As the compound was found in the form of metachloral, it is probable that the explosion was due to sudden polymerization.

Synthesis of Hexamethylene-Glycol Diethyl Ether and Other Ethers from Trimethylene Glycol. By Arthur A.

NOYES. *Am. Chem. J.*, **19**, 766–781.—The results of the investigation are as follows: The monoethyl ether of trimethylene glycol is readily prepared by the action of sodium and ethyl iodide on a considerable excess of the glycol. The diethyl ether was prepared from the monoethyl ether, but not from the glycol itself, by a similar process. By the action of phosphorus trichloride, tribromide, and diiodide on the monoethyl ether, the hydroxyl was replaced by halogen with the production of ethyl chlor-, brom-, and iodpropyl ethers. The yields obtained were about 50, 75, and 30 per cent. respectively. Hydriodic acid gas at 0° caused replacement of the ethoxy as well as the hydroxyl group. The diethyl ether of hexamethylene-glycol was found to be produced in very small quantity by the action of sodium on an ethereal solution of ethyl chlorpropyl ether and in somewhat larger quantity by the similar reaction with the corresponding brom and iodo ether; but the best yields did not exceed 30 per cent. of the theoretical. By heating the ethyl brompropyl ether in a water-bath for several hours, first with a slight excess of concentrated aqueous potassium cyanide solution, and then with concentrated potash and acidifying, γ-ethoxyvalerianic acid was obtained in a 40 per cent. yield. It was shown that by the electrolysis of the salt of this acid a small quantity of hexamethylene-glycol diethyl ether is probably formed. Attempts to prepare a metallic derivative by the action of sodium amalgam and of the zinc-copper couple on the ethyl brompropyl ether, were unsuccessful. The Fittig synthesis was successfully carried out with the bromether and brombenzene, a 54 per cent. yield of ethyl γ-phenylpropyl ether being obtained. The ethoxypropyl radical was also readily introduced into malonic ester by heating its sodium compound with the ethyl brompropyl ether, the yield being 34 per cent. The substituted malonic ester so obtained gave on saponification and subsequent heating to 170° of the acid separated from its salt, δ-ethoxyvalerianic acid in a 37 per cent. yield. Another substance was produced at the same time in considerable quantity, but its nature was not determined.

Chemical Bibliography of Morphine, 1875-1896. BY H. E. BROWN. *Pharm. Rev.*, **15**, 204–205.—This important bibliography is being made under the supervision of A. B. Prescott, and when completed will be of great value.

GEOLOGICAL AND MINERALOGICAL CHEMISTRY.

W. O. CROSBY, REVIEWER.

Fractional Crystallization of Rocks. BY GEORGE F. BECKER. *Am. J. Sci.*, 154, 257–261.—This paper supplements the author's vigorous and effective criticism of the theory of magmatic differentiation based upon molecular diffusion in accordance with Soret's principle, as first proposed by Iddings (see this *Rev.*, 3, 67). In the former paper the author was content to demolish the prevalent theory, and confessed himself unable to propose any better alternative hypothesis than that the differences between well-defined rock types are due to original and persistent heterogeneity in the composition of the globe. But now he accepts differentiation as a fact and brings forward the simple and familiar principle of fractional crystallization to account for it. He conceives that during the circulation of the magma, due to inevitable convection currents, convection being the mortal enemy of any process of separation involving molecular flow, the less fusible constituents crystallize on the relatively cool walls, and the residual magma is composed in increasing proportion of the more fusible constituents, until the condition of maximum fusibility or eutexia is reached, after which differentiation necessarily ceases. The limitation imposed upon this process by viscosity is recognized; but in dikes and laccolites of mobile lavas, convection and fractional crystallization are inevitable. And this simple principle, which is the very opposite of magmatic differentiation and almost inseparable from consolidation, unquestionably affords the best explanation yet proposed of the differences observed in many igneous masses; and, as the theory requires, many homogeneous masses are undoubtedly approximately eutectic.

Eopaleozoic Hot Springs and the Origin of the Pennsylvania Siliceous Oolite. BY GEORGE R. WIELAND. *Am. J. Sci.*, 154, 262–264.—The author accepts the view of Bergt and Hovey that the beautiful siliceous oölite occurring in bowlders derived from the calciferous formation near the State College in Center County, Pa., is not pseudomorphic after ordinary or calcareous oölite, but due to direct deposition from silica-laden waters of Hot Springs. Additional confirmation of this view is afforded by the fact that in the limited oölite area and nowhere else in the entire region are found in considerable numbers bowlders of a built-up structure which may have formed the veins of hot springs or geysers. An analysis of the oölite shows 99.1 per cent. of silica. Analyses of two less pure varieties of siliceous oölite are also given.

Pseudomorphs from Northern New York. By C. H. Smyth, Jr. *Am. J. Sci.*, **154**, 309–312.—Describes pseudomorphs of pyroxene after Wollastonite from Diana, and of mica after scapolite and pyroxene from near Gouverneur. The chemical relations of the species are considered, but no analyses are given.

On the Chemical Composition of Hamlinite and its Occurrence with Bertrandite at Oxford County, Maine. By S. L. Penfield. *Am. J. Sci.*, **154**, 313–316.—Only recently has enough of this rare phosphate for a complete analysis been found. The mineral was separated by heavy solutions from every associated species except apatite, and from this by boiling in dilute hydrochloric acid, all possible precautions being taken to obtain the hamlinite in a state of purity. Traces of adhering feldspar and mica, however, could not be wholly avoided; and to this source are referred the small proportions of Fe_2O_3, SiO_2, and of alkalies with their equivalent of the Al_2O_3, which the analysis reveals. Deducting these and calculating the remainder to 100 per cent., we have as the normal composition of hamlinite; P_2O_5, 30.20; Al_2O_3, 32.67; SrO, 19.25; BaO, 4.18; H_2O, 12.53; F, 2.01; corresponding very closely to the formula $[Al(OH)_2]_3[SrOH]P_2O_7$, the Sr being replaced by Ba in the ratio of 7 : 1, and the OH by F in the ratio of 13 : 1. In its chemical composition hamlinite holds a unique position among minerals as strontium and barium have never before been observed as essential constituents of a phosphate, and this is the first time that a pyrophosphate has been recorded.

Italian Petrological Sketches, V., Summary and Conclusion. By Henry S. Washington. *J. Geol.*, 5, 349–377.—The volcanoes of the main Italian line, extending from Tuscany to Naples, embrace two types—great strata volcanoes, characterized by leucitic lavas and a great variety of products, and smaller but more prominent cones, the lavas of which are non-leucitic and consist of but a single extreme (acid or basic) type for each cone, the most of the lavas being referable to the trachy-dolerites, which include ciminite, vulsinite, and toscanite. In the descriptions of these subtypes all known reliable analyses, 41 in number, are quoted and discussed, and the normal proportions of the component minerals computed for each rock. In discussing the correlation of the trachy-dolerites, the author proposes a general classification of the feldspathic effusive rocks based upon the dominant feldspar and the proportion of silica. The classification and nomenclature of the leucitic lavas are regarded as provisional, the leading types being leucitite, leucite-basalt, leucite-basanite, leucite-tephrite, leucite-trachyte, and leucite-phonolite. Each type is briefly characterized, and 18 analyses are selected for comparison and discussion. The interesting fact is thus brought out that the silica ratio, the upper limit of which is 60 per cent., does not present a perfect gradation, but the analyses are grouped about 49 and 56 per cent. A similar clustering of the analyses about definite points is noted for the trachydolerites, and for other constituents than silica, especially Fe_2O_3, FeO, MgO, and CaO. That is, in neither group do the analyses form a gradual series, from the most basic to the most acid, as Brögger understands a series to be constituted. A similar relation is shown to hold for the lavas of other regions; and an explanation is found in the theory of magmatic differentiation, the process having completed its course in these instances. The author concludes, however, that the two main groups of rocks do not represent two distinct primary differentiation products, but that their differences are due to diverse differences of extrusion and solidification. In other words, primary magmatic differentiation gives the distinction of acid and basic observed in each group, but the varying conditions of extrusion determine the development, now of leucite and again of feldspars. The parent magma is shown to have been rich in potash and lime, and its normal composition is supposed to have been approximately: SiO_2, 57–58; Al_2O_3, 17–18; total iron oxides as FeO, 6–7; MgO, 2–3; CaO, 5.0–6.5; Na_2O, 2–2.5; K_2O, 7–8; H_2O, 1–1.5 per cent.

Secondary Occurrences of Magnetite on Islands of British Columbia by Replacement of Limestone and by Weathering of Eruptives. BY JAMES P. KIMBALL. *Am. Geol.*, **20**, 13–27.—Two separate types of ferriferous deposits, due to hydrochemical replacements, are recognized. One is a morphological replacement of limestone by double decomposition between ferrous salts and calcic carbonate, the former being derived from ferrous silicates; the other type is a partial, and not necessarily pseudomorphic, replacement of ferrous silicates in weathered basic rocks, or more explicitly, a residual concentration or fixation of iron oxides incidental to development of soluble alkaline carbonates from weathering oxidation or splitting up of ferriferous silicates. The common association of the deposits of this type with limestone is regarded as significant, calcic carbonate taking the place, in part, of the alkaline carbonates as an agent for the precipitation of ferric oxide. Among the causes determining the locus of deposition are recognized molecular or concretionary attraction of the mass for homologous matter in passing solutions, or even in suspension, the last being otherwise designated by the author as the extra molecular tendency of ochreous material to form concretions or aggregations. As might be inferred from the above, the two types of deposit, that due to replacement of limestone, and that due to the replacement of basic silicates through the agency of contiguous limestone, are often intimately associated. The probable details of these metasomatic changes are stated; and the illustrative occurrences on three islands are described, the paper concluding with four analyses of magnetite from these and related deposits.

On the Magnetite Belt at Cranberry, North Carolina, and Notes on the Gensis of this Iron Ore in General in Crystalline Schists. BY JAMES P. KIMBALL. *Am. Geol.*, **20**, 299–312.—This paper is in line with the preceding. The Cranberry iron ore deposits are described as obscurely defined lenses of magnetite in a persistent belt of pyroxene and amphibole; and the author, rejecting the theory of original magmatic differentiation as an explanation of these and many similar ore bodies, regards the magnetite and its encircling zone of epidote as derivatives through hydrochemical or weathering processes from the enclosing basic silicates. This view is supported by the observation that epidotization of pyroxene from weathering action is practically limited to the superficial zone of rock decay, increasing with proximity to the surface. But no facts are cited to show that the magnetite is also limited in depth; and the proof that the epidote is coeval with the magnetite or genetically related to it is inconclusive. Three analyses of the Cranberry ore are quoted, showing the composition of the purest magnetite obtainable, of the mixed magnetite and epidote, and of the ore as prepared for market, the percentages of metallic iron being respectively 64.64, 32.37, and 45.93. A notable proportion (seven per cent. in one instance) of the iron obtained in the furnace is attributed to ferrous and ferric oxides in the associated silicates —pyroxene and its derivative (epidote)—an analysis of pure pyroxene giving 24.01 per cent. of metallic iron. In the further discussion of the origin of these and similar ore deposits, the author holds that even if we grant that magmatic differentiation has played a part, it must have been supplemented by subsequent hydrochemical processes to convert the original ferriferous silicates (pyroxene, etc.) to bodies of highly concentrated magnetite.

The Fisher Meteorite. Chemical and Mineral Composition. BY N. H. WINCHELL. (CHEMICAL ANALYSIS, BY C. P. BERKEY.) *Am Geol.*, **20**, 316–318.—Prof. Winchell gives the results of microchemical tests for determining a mineral resembling maskelynite. Not enough of the mineral is present to warrant a quantitative analysis; and the presence of maskelynite is inferred from the feeble polarization, absence of cleavage, presence of lime and soda, and the fact that the glass from which it seems to have crystallized contains soda, and no soda has been detected in the other minerals. Mr. Berkey gives a bulk analysis of the meteorite, showing the presence of Si, Al, Fe, Ni, Ca, Mg, and S. The sulphur is present in small quantity in the mineral troilite and no alkalies were found.

Note on the Hypersthene-Andesite from Mt. Edgecumbe, Alaska. By H. P. Cushing. *Am. Geol.*, **20**, 156–158.—The specimens examined were collected by H. F. Reid in the crater of the volcano, which has probably not been long extinct. They are a quite normal hypersthene-augite-andesite made up of plagioclase, hypersthene, augite, and magnetite, in the order of abundance. It is the only occurrence of andesite reported from Alaska, except the hornblende-andesite of Bogosloff Island, and it is of interest from the fact that similar lava is found throughout the whole extent of the American Sierra belt.

Ferric Sulphate in Mine Waters, and Its Action on Metals. By L. J. W. Jones. *Proc. Col. Sci. Soc.*, June 5, 1897, 1–9.—The corrosive action of the water of the Stanley Mine, Idaho Springs, Col., is so great that ordinary iron pipe cannot long resist it. The substitution of copper and various alloys for iron proved unavailing. On standing, the water yields a muddy brown precipitate which, after drying, gave on analysis: Fe_2O_3, 53.57; Al_2O_3, 2.87; SiO_2, 10.85; SO_3, 11.46; H_2O, 21.14; total, 99.89. It is evidently a hydrated basic sulphate of iron. An analysis of the water filtered off from the precipitate shows, besides silica and sodic chloride, sulphate of Na, K, Al, Zn, Mn, Mg, Ca, Fe (ferrous and ferric), and Cu, the ferric, calcic, magnesic, and sodic sulphates predominating, and the whole slightly exceeding three parts in one thousand. Free sulphuric acid is not present, and the corrosive action of the water is attributed in part to the copper sulphate, but chiefly to the ferric sulphate. After noting the action of the water the lead, copper, and bronze, the conclusion is reached that wooden pipes are the most serviceable.

1. Lead and Zinc Ores of Iowa. By A. G. Leonard. **2. The Sioux Quartzite and Certain Associated Rocks.** By S. W. Beyer. **3. Artesian Wells of Iowa.** By W. H. Norton. *Iowa Geol. Survey*, **6**, 11–429.—In the first paper the chief sources of the world's supply of lead and zinc are cited, and their mode of occurrence in north-eastern Iowa fully described. The lead occurs mainly as sulphide, and the zinc as carbonate; the two ores being associated, but seldom intermingled. The concentration has been effected by lateral secretion from the limestone by infiltrating surface waters.

2. The Sioux quartzite extends across the north-western corner of Iowa into Minnesota and South Dakota ; but the author considers especially its exposures and its relation to certain associated rocks in the latter state. The quartzite is there cut by a large mass of olivine diabase; and the alteration products of the feldspar, augite, and olivine of the diabase are described.

3. After a general discussion of the definition and theory of artesian wells and of artesian conditions in Iowa, the author gives a detailed record of the wells in the state and chemical analyses of the waters, many of which are strongly mineral. The contained gases are ammonia, hydrogen sulphide, and carbon dioxide, oxygen not having been observed. The dissolved solids are carbonates of Ca, K, and Fe ; bicarbonates of Mg and Na ; phosphates of Mg and Na; sulphates of Ca, Mg, Na, and K; ferric oxide; chlorides of Mg, Na, and K; silica and alumina, some of the wells containing a greater proportion and larger variety than others. Their sanitary, therapeutic, and industrial value are discussed, and analyses are also given of the river, surface, and drift waters of the state.

The Marquette Iron-bearing District of Michigan. By Charles Richard Van Hise and William Shirley Bayley. *Monographs U. S. Geol. Survey*, **28**, 1–608.—This elaborate and beautifully illustrated report is designed as a final account of the geological structure and petrography of the oldest iron-producing area of the Lake Superior region. The petrographic descriptions are accompanied now and then by analyses of the rocks—granitite, gneiss, schist, slate, greenstone, peridotite, serpentine, etc. The chief iron-bearing horizon is the Negaunee formation; and it is here that the chemical interest of the report culminates. Petrographically the iron-bearing formation comprises sideritic slates, which may be grüneritic, magnetitic, hematitic, or limonitic ; grünerite-magnetite-schists ; ferruginous slates; ferruginous cherts; gaspilite; and iron ores. The descriptions of these rocks, with analyses of the sideritic slates, grünerite-magnetite-schists, and jaspilite, are followed by a section on the origin of the ores, which may be summarized as follows: The ores are not eruptive. The original form of the iron is the carbonate-siderite; and the whole of the iron-bearing formation was probably originally a lean cherty carbonate of iron with some calcium and magnesium. From this rock the ferruginous cherts and jaspers were developed by peroxidation of the iron and solution of the calcareous materials. The ore bodies proper are due to a secondary enrichment by the action of downward percolating water. They invariably rest upon an impervious substratum, usually of soaprock, and the convergence of the downward-flowing waters determined by pitching synclines or the intersection of the impervious soaprock by greenstone dikes has favored the concentration of the ore. The immediate cause of the deposition of the iron at these points is found in the oxidation of the dissolved carbonate by oxygen-bearing waters coming more directly from the surface. It is further essential to the formation of pure ores that the waters, rendered alkaline by the alteration of alkaline silicates to soap rock, should dissolve and remove large amounts of silica (chert, etc.).

Geology of the Denver Basin in Colorado. BY SAMUEL FRANKLIN EMMONS, WHITMAN CROSS, AND GEORGE HOMANS ELDRIDGE. *Monographs U. S. Geol. Survey*, 27, 1–556.—In this very complete study of a limited area of only moderate geologic complexity, we find analyses of the rocks of greatest chemical interest, including Wyoming and Niobrava limestones, the Benton and Laramie iron stones (earthy and concretionary carbonates), löess, dolerite and augite from it, basalt, augite-mica-syenite, tuff, coals, and fire-clays ; and also artesian waters. The löess is distinguished from that of the Mississippi and Rhine valleys by its higher proportion of alkalies, indicating that, owing to the avidity of the climate, the feldsparthic constituent is but little decomposed. The numerous analyses of coal were made partly in Denver, and partly in Washington ; and the curious fact is developed that, although they were all made by the same chemist, in the same manner, with the same care, and at the same temperature, the Washington analyses showed from 3 to 5 per cent. less moisture than the Denver analyses, while the volatile combustible matters are found to vary in the opposite direction, increasing as the water decreases. The specific gravities also vary inversely as the water and directly as the volatile combustible matters. It is a significant fact that the sum of the volatile combustibles and water is approximately the same for both the Washington and Denver analyses. The discussion of these anomalous and seemingly contradictory facts leads to the conclusion that the hygrometric condition of the atmosphere must be the cause of these persistent discrepancies. In the drier atmosphere of Denver, under less barometric pressure, the coals parted with a greater amount of moisture than it is possible to expel under the usual conditions of analysis in the more moist atmosphere and with the higher barometer of the east. Since the water not expelled must be reckoned as volatile combustible matter, the economic value of the coal is involved; and it is suggested that the limits of the atmospheric influence should be determined and taken into account in all future analyses of coal. The fixed carbon is found to increase with the depth, ranging in the Golden mines from 38.32 per cent. at 130 feet, to 43.42 per cent. at 650 feet. The further discussion includes the ash, fuel ratio, and classification of the coals. A comparison of the fire-clays with those of Eastern and European localities, and with pure kaolin, shows that they are in the main of excellent quality. In connection with an extended account of the artesian wells, relating chiefly to the geological conditions, available supply of water, rate and diminution of flow, four analyses by Prof. Chauvenet are quoted, the total solids ranging from 17.20 to 56.60 parts in 100,000, sodium carbonate largely predominating.

The Gold Quartz Veins of Nevada City and Grass Valley, California. BY WALDEMAR LINDGREN. *U. S. Geol. Survey, Ann. Rep.*, 17, *part 2*, 1–262.—The first essential to understanding the geology of this region is the distinction of the bed-rock series of crystalline schists and ancient igneous rocks and the relatively modern gravels, sands, clays and volcanic rocks which overlie them horizontally. The igneous rocks of the bed-rock series are in the main of mixed granitic and dioritic (granodiorite) character and of complex mineralogical and chemical composition. They also include diabases, gabbro, pyroxenites, peridotites, porphyrite and amphibolite, analyses of which are given, as well as of serpentine derived from the basic eruptives, and the superjacent rhyolite tuffs, and associated clays and sandstones. The sedimentary rocks, including clay slate, siliceous argillite, (of which one complete analysis is given) quartzitic sandstone and chert, are supposed to be altered Carboniferous strata, and are distinctly older than the granodiorite and and diabasic series; while above them is a series of clay slates of the upper Jurassic. The metamorphic processes to which these rocks have been subjected are: Regional or dynamo-chemical metamorphism; contact metamorphism; hydro, hydrothermal, and solfataric metamorphism; serpentinization of magnesian silicates; and surface weathering. Each process is briefly described and its products enumerated. The development of the iron sulphides is specially considered, as having an important bearing upon the genesis of the ore deposits; and for the same reason the section on the mineralogy of the veins is accompanied by analyses of the mine waters and the deposits which they form, and of the liquid inclusions of the quartz. Several analyses of the sulphurets (concentrates), amounting to 2 to 3 per cent. of the ore, show the normal ratios of the base metals, as well as of gold and silver. The changes in the rocks, due to the formation of the veins, are discussed at some length, with numerous analyses. In the discussion of the genesis of the veins the conclusion is reached that they were formed at a great depth by ascending thermal waters, lateral secretion playing but a very minor part; and in confirmation of this view numerous assays and analyses are cited, showing that the wall rocks rarely contain appreciable traces of gold. The details of the discussion relate to the origin of the metals and gangue, solubility and synthesis of the gangue minerals, sulphides, and gold, relation of solubility to temperature and pressure, precipitation of the gold and mode of deposition of the vein minerals.

Geology of Silver Cliff and the Rosita Hills, Colorado. By Whitman Cross. *U. S. Geol. Survey, Ann. Rep.*, 17, *part 2*, 263–403.—In the geological history of this district an ancient complex of granite and various gneissic rocks was cut by dikes of syenite, diabase and peridotite, and then subjected to prolonged erosion previous to the outbreak of volcanic action. This volcanic center is comparable to the one at Cripple Creek, and from it poured at successive periods varieties of andesite, diorite, dacite, rhyolite, trachyte, and finally the Bassick agglomerate. Nearly all of these types were analyzed, and the rocks of the volcanic series are tabulated for comparison. The decomposition products are of great extent and interest; and analyses are given of quartz-alunite rock (the first known occurrence in this country of crystalline alunite as a rock constituent), quartz-diaspore rock, pitchstone and the siliceous clay derived from it, and muscovetized rocks derived from several vulcanic types. The sequence of the lavas is discussed and the evidences of differentiation noted.

The Mines of Custer County, Colorado. By Samuel Franklin Emmons. *U. S. Geol. Survey, Ann. Rep.*, 17, *Part 2*, 405–472.—This monograph supplements the preceding, discussing the mining geology of Rosita and Silver Cliff, as that does the general geology. It is in the main an account of four mines, representing four types of deposits. The Pocahontas-Humbolt is a true fissure vein. The Bassick is the most typical example yet described of a neck vein, consisting of a well-defined ore-shoot or chimney formed by fumarole action in the coarse andesitic agglomerate filling an old volcanic neck, and the ore, of which a single analysis is given, occurring as successive coatings on the rounded masses and bowlders of andesite. The Bull Domingo is structurally similar to the Bassick, being a nearly vertical chimney in a conglomeratic mass of the granite and gneiss country rock, with the ores coating the bowlders and fragments ; but the origin of the bowlder zone or stock is found in the intersection of a complicated series of fractures and not in volcanic action. At Silver Cliff the ore (silver chloride) occupied irregular cracks in the surface flow of rhyolite, but in the deep workings of the Geyser Mine, where the rocks are firmer, the ore (argentiferous sulphides) forms a well-defined but narrow vein. This mine, now one of the deepest in the West, is described in detail, with complete analyses of the decomposition products of the rhyolite, the ores and gangues, the calcareous and slightly metalliferous sinters deposited by the mine waters, the vadose or surface waters from the upper levels of the mine, and the similar but more concentrated deep waters from the lower levels. The relations of these waters to the ore deposition are discussed, and as evidence that the ores of this district may have been derived from the enclosing formations. Ten assays of the country rocks are given, all but four showing appreciable amounts of silver. In conclusion this district is compared, as regards the character of the ores, with the analogous Cripple Creek District, forty miles north of it.

The Tennessee Phosphates. BY CHARLES WILLARD HAYES. *U. S. Geol. Survey, Ann. Rep.*, 17, *Part 2*, 513–550.—A preliminary account of these phosphates appeared in the 16th Annual Report (see *this Rev.*, 2, 57). They are classed as structural varieties of the two main types—the black and the white phosphates, the former originating in the deposition of a bed of phosphatic organisms in the Devonian Sea, while the latter is a secondary and essentially residuary deposit due to the differential solvent action of meteoric waters on phosphatic limestones. Analyses are given only for the white phosphates, giving from 27.4 to 33.4 per cent. of calcium phosphate ($Ca_3P_2O_8$).

The Underground Waters of the Arkansas Valley in Eastern Colorado. BY GROVE KARL GILBERT. *U. S. Geol. Survey, Ann. Rep.*, 17, *Part 2*, 551–601.—The water-bearing strata of this district are the sandstones of the Dakota group, the lowest member of the Cretaceous formation. A detailed account of the geological structure of the valley precedes the discussion of the water supply. The analyses of the artesian waters show a rather complex mineral constitution, with salts of Na, Ca, and Mg predominating, the maximum total solids being over 4,000 parts in 1,000,000.

Preliminary Report on Artesian Waters of a Portion of the Dakotas. BY NELSON HORATIO DARTON. *U. S. Geol. Survey, Ann. Rep.*, 17, *Part 2*, 603–695.—The water-bearing formation, as in the Arkansas Valley, is the Dakota sandstone, which receives its supply where it outcrops to the westward in the foot hills of the Rocky Mountains and the Black Hills, and which underlies nearly the whole of North and South Dakota, rising again to the surface near their eastern boundaries. The water is saline, containing considerable amounts of NaCl, and carbonates and sulphates of Na, Ca, and Mg, but rarely enough to affect its usefulness.

The Water Resources of Illinois. BY FRANK LEVERETT. *U. S. Geol. Survey, Ann. Rep.*, 17, *Part 2*, 695–828.—The rainfall and drainage of the state are discussed and the sources of supply of water for power and for the use of cities, villages, and rural districts, are described. The wells afford chiefly surface waters, but numerous analyses are given for both shallow and artesian wells, showing the proportions of inorganic and organic impurities. Few of the waters are strongly mineral, but many are seriously contaminated by drainage.

REVIEW OF AMERICAN CHEMICAL RESEARCH.

VOL. IV. NO. 2.

ARTHUR A. NOYES, Editor; HENRY P. TALBOT, Associate Editor.
REVIEWERS: Analytical Chemistry, H. P. Talbot and W. H. Walker; Biological Chemistry, W. R. Whitney; Carbohydrates, G. W. Rolfe; General Chemistry, A. A. Noyes; Geological and Mineralogical Chemistry, W. O. Crosby; Inorganic Chemistry, Henry Fay; Metallurgical Chemistry and Assaying, H. O. Hofman; Organic Chemistry, J. F. Norris; Physical Chemistry, H. M. Goodwin; Sanitary Chemistry, E. H. Richards; Technical Chemistry, A. H. Gill and F. H. Thorp.

GENERAL AND PHYSICAL CHEMISTRY.

A. A. NOYES, REVIEWER.

The Dissociation of Electrolytes as Measured by the Boiling-Point Method. BY HARRY C. JONES AND STEPHEN H. KING. *Am. Chem. J.*, 19, 753-756.—The authors have determined the rise in boiling-point produced by dissolving potassium iodide and sodium acetate in alcohol, their chief object being to show the constancy of the values obtained by Jones' modification of the Beckmann apparatus (*this Rev.*, 3, 183) and the practicability of determining dissociation values by means of it. In the case of potassium iodide, the concentration varied in five experiments between 1.8 and 3.1 per cent., and the dissociation values betweed 25.4 and 27.2 per cent.; while in the case of sodium acetate for concentrations between 1.0 and 2.1 per cent., the dissociation was only 1.0 to 1.8 per cent. These results are regarded as preliminary.

The Rate of Solution of Solid Substances in their own Solutions. BY ARTHUR A. NOYES AND WILLIS R. WHITNEY. *J. Am. Chem. Soc.*, 19, 930-934.—The authors have found, by agitating sticks of benzoic acid and of lead chloride with water for different lengths of time, that "the rate at which a solid substance dissolves in its own solution is proportional to the difference between the concentration of that solution and the concentration of the saturated solution."

On a Possible Change of Weight in Chemical Reactions. BY FERNANDO SANFORD AND LILIAN E. RAY. *Phys. Rev.*, 5, 247-253.—The authors have carried out a series of experiments similar to those of Landolt (*Ztschr. phys. Chem.*, 12, 1). They find that, when ammoniacal silver nitrate and grape sugar solutions are caused to react within a closed vessel, the change of weight observed does not exceed the probable errors of the weighings, which is calculated to be about 0.04 milligram or $\frac{1}{8,000,000}$ part of the weight of the reacting substances.

Note on the Rate of Dehydration of Crystallized Salts. BY THEODORE WILLIAM RICHARDS. *Proc. Am. Acad.*, 33, 23–27. —The author has made experiments showing that crystallized barium chloride ($BaCl_2.2H_2O$), when placed in a desiccator over phosphorus pentoxide, loses its water rapidly and fairly uniformly until one molecule of water has escaped, and that then the rate of loss suddenly becomes much less, but again remains quite uniform as the dehydration progresses. The author seems to have overlooked the fact that similar experiments giving the same result have been made with this very salt by Müller-Erzbach (*Wied. Ann.*, 27, 623). Andreae (*Ztschr. phys. Chem.*, 7, 241) has also made accurate and extensive experiments in the same direction. The author has also compiled from existing data a table showing the specific gravity of sulphuric acid solutions which have definite vapor-pressures at 20°, 25°, and 30°.

Two Liquid Phases, II. BY WILDER D. BANCROFT. *J. phys. Chem.*, 1, 647–668.—There is given in this article "a graphical summary of the equilibria in three-component systems when one pair, two pairs, and three pairs of the components can form two liquid phases." In the latter part of the paper the author claims that the chemists who have investigated the principles of solubility-effect have stated that the solubility of any substance can be affected only by those other substances which bring into the solution one of its dissociation-products. As a matter of fact, no such absurd statement has ever been made by the "quantitative physical chemists;" on the contrary, the reviewer has emphasized on different occasions (*Ztschr. phys. Chem.*, 6, 243; 9, 603) the fact that the solubility-principles cannot be expected to hold true exactly, when the second substance is of such a nature or is added in so large an amount as to produce an appreciable change in the solvent power of the solvent.

The Electrolysis and Electrical Conductivity of Certain Substances Dissolved in Ammonia. BY HAMILTON P. CADY. *J. phys. Chem.*, 1, 707–713.—The author has made the interesting discovery that many salts dissolved in liquid ammonia at —34° have even a greater electrical conductivity than when dissolved in pure water at +18°. The ammonia employed was the commercial article used in the manufacture of ice; it had a conductivity of 71×10^{-7}. As it no doubt contained impurities, and as there were difficulties in the determinations, the results are regarded only as preliminary. They serve, however, to give a general idea of the prevailing conditions. The molecular conductivity of salts was found to increase with the dilution as in the case of water. Some salts, especially mercury iodide and cyanide, which have only a very slight conductivity in water, were found to be good conductors, showing that the dissociating power of ammonia is greater than that of water. The rate of motion of ions through it seems also to be greater than through water. The author has also submitted the solutions of a number of salts in ammonia to electrolysis: in the case of lead, mercury, and silver salts, the metals are deposited on the cathode; in the case of iodides, a dark-colored explosive compound, believed to be HN_3I, separated at the anode; with potassium iodide, potassium amide was probably formed at the cathode; etc. The most remarkable results were obtained with a solution of metallic sodium. Although an excellent conductor, there was no indication of electrolysis when a current was passed through: no deposit formed on the electrodes; no gas was set free; and no polarization-current could be detected. The article seems to the reviewer to open up a most interesting and important field of investigation; and it is to be hoped that the author will continue the work under improved conditions as soon as possible.

Precipitation of Salts. BY A. ERNEST TAYLOR. *J. phys. Chem.*, 1, 718–733.—The article describes a continuation of the work previously referred to (*this Rev.*, 3, 75, 122, 152).

A Revision of the Atomic Weight of Nickel. I. The Analysis of Nickelous Bromide. BY THEODORE WILLIAM RICHARDS AND ALLERTON SEWARD CUSHMAN. *Proc. Am. Acad.*, 33, 97–111.—Commercial nickel and pure nickel obtained by the carbon monoxide process were subjected to extensive processes of purification. From the former, two samples of nickel bromide were obtained differing from one another in the number of purifying operations to which they had been submitted; and from the latter two further samples even more carefully purified were prepared. In addition to the usual methods of purification, the ammonia compound $NiBr_2.6NH_3$ was repeatedly crystallized from strong ammonia; and the nickel was three times fractionally precipitated by electrolysis. All four samples of nickel bromide were sublimed, ignited at 400° in a current of hydrobromic acid, and cooled in nitrogen. The exact quantity of silver required for its precipitation was determined; and the silver bromide formed was weighed, thus giving two independent ratios, $2AgBr : NiBr_2$ and $2Ag : NiBr_2$. The mean value of the atomic weight obtained from the former ratio in seven experiments made with the two most carefully purified samples was 58.690

(±0.003), while that obtained from the latter ratio was 58.691 (±0.005). Very strong evidence of the purity of the substance analyzed is furnished by the fact that the four samples, which had been submitted successively to more numerous processes of purification, gave nearly the same results; namely, 58.677, 58.683, 58.688, 58.689. The authors adopt 58.69 (O = 16) as the most probable value. That given by Clarke in his last year's report was also 58.69.

A Revision of the Atomic Weight of Cobalt. I. The Analysis of Cobaltous Bromide. BY THEODORE WILLIAM RICHARDS AND GREGORY PAUL BAXTER. *Proc. Am. Acad.*, 33, 115–128. —This investigation is closely analogous to that on the atomic weight of nickel described in the preceding review. The cobaltous bromide used was purified, after removal of the metals of the hydrogen sulphide group, by three processes: first, by precipitation of the potassium cobaltic nitrite and subsequent electrolytic deposition of the metal; second, by precipitation in the form of the purpureochloride and subsequent electrolytic deposition; and third, by a combination of both these processes. The bromide was in each case finally sublimed, ignited in a current of hydrobromic acid, and cooled in one of nitrogen. The mean value of the atomic weight obtained from nine determinations of the ratio $2AgBr:CoBr_2$ was 58.995 (±0.003), while that from eight determinations of the ratio $2Ag:CoBr_2$ was 58.987 (±0.005). The four differently purified samples gave 58.987, 58.992, 58.995, and 59.004. The authors adopt 58.99 as the most probable value, while that given by Clarke in his last year's report was 58.93.

H. M. GOODWIN, REVIEWER.

On Electrosynthesis. BY W. G. MIXTER. *Am. J. Sci.*, 154, 51–62.—Electrosynthesis the author defines to be the chemical union of substances by an electric discharge as distinct from combination effected by the heat of the discharge. A feeble glow discharge from an induction coil driven by one storage cell and giving a spark in air about one centimeter long was used in the experiments for effecting the combination. The amount of combination of oxygen with hydrogen in a discharge tube connected in series with the tube under investigation, served in all cases as an arbitrary standard of reference. A measure of the chemical action was obtained by absorbing the products of the combination directly in the vacuum tube and noting the corresponding diminution of pressure on a manometer. Experiments were made at varying pressures. If the number of hydrogen and oxygen molecules combining be taken as 100, the corresponding values for the mixtures of other gases with oxygen are as follows: Carbonic oxide, 113; methane, 149; ethylene, 300; acetylene, 320; and ethane, 150. From a consideration of these results the author concludes that the glow discharge renders gaseous molecules chemically active, and that the molecular charges involved in "electrosynthesis" are analogous to those often produced by light, or by heat at temperatures below that at which gaseous dissociation is measured.

On the Temperature-Coefficient of the Potential of the Calomel Electrode, with Several Different Supernatant Electrolytes. BY THEODORE WILLIAM RICHARDS. *Proc. Am. Acad.*, 33, 1-20.—This is an experimental study of the electromotive force of elements of the type Hg, HgCl, MCl_n, HgCl, Hg, the two electrodes being at different temperatures. A careful preliminary study of the causes affecting the potential difference of calomel electrodes revealed the fact that the depolarizer HgCl is slightly decomposed into mercuric chloride and mercury; the amount of decomposition being greater, the higher the temperature and the more concentrated the soluble electrolyte, MCl_n, present. To this fact is attributed the slight inconstancy of normal calomel elements. It is suggested that a decinormal calomel electrode would be a more constant standard electrode, on this account. Measurements of the temperature-coefficient between 0° and 30° of calomel electrodes in contact with normal, decinormal, and centinormal solutions of eleven different soluble chlorides showed that it invariably diminishes with increasing concentration. The diminution is shown to be very approximately in the ratio of the logarithm of the concentrations. Hydrochloric acid and ammonium chloride are anomalous in their behavior.

ANALYTICAL CHEMISTRY.

ULTIMATE ANALYSIS.

H. P. TALBOT, REVIEWER.

The Estimation of Phosphorus in Steel. BY R. W. MAHON. *J. Am. Chem. Soc.*, 19, 792-795.—The author describes a rapid method, successfully used with steels low in carbon and silicon and free from arsenic, which, he claims, will afford accurate results in about eight minutes. The procedure includes the partial neutralization of the nitric acid and precipitation of the phosphomolybdate at a temperature near the boiling-point, and after shaking for fifteen seconds. The precipitate and filter are placed in a measured excess of caustic alkali; and the excess is determined by standard acid, with phenolphthalein as an indicator.

The Titration of Stannous Salts with Iodine. BY S. W. YOUNG. *J. Am. Chem. Soc.*, 19, 809–812.—The author states that the reaction between stannous chloride and iodine, by which the former is oxidized, takes place smoothly in acid solution, and may be utilized for the determination of tin. The iodine solution is standardized against potassium bichromate with the intervention of a stannous chloride solution of known value. The statements are made that "thiosulphate cannot be satisfactorily used in acid solution to titrate against iodine," and that "the standard of iodine by thiosulphate is likely to be a trifle high;" but no authorities are quoted nor experimental data offered in support of these assertions.

The Electrolytic Determination of Cadmium. BY DANIEL L. WALLACE AND EDGAR F. SMITH. *J. Am. Chem. Soc.*, 19, 870–873.—The paper presents data which refute the statements of Heidenreich (*Ber.*, 29, 1585) and Avery and Dales (*this Rev.*, 3, 123), in which they deny that cadmium can be precipitated electrolytically from solutions of the acetate and sulphate, and that a separation of cadmium and copper can be effected in nitric acid solution. Under the conditions prescribed in this paper the precipitation of the cadmium by electrolysis appears to be complete, as previously affirmed.

The Analysis of Bearing-Metal Alloys, with a New Volumetric Method for Determining Copper. BY W. E. GARRIGUES. *J. Am. Chem. Soc.*, 19, 934–948; *Proc. Eng. Soc. W. Penna.*, 13, 415–430. The analysis of bearing-metal alloys is treated in this paper from a general standpoint, their sources of inaccuracy are discussed, and remedies are suggested. For the determination of copper, the precipitation of the metal as cuprous thiocyanate, filtration, and the treatment of the precipitate with an excess of caustic alkali are suggested. The excess of the alkali is then determined by titration.

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ANALYTICAL CHEMISTRY.

ULTIMATE ANALYSIS.

HENRY FAY, REVIEWER.

Iodometric Determination of Selenious and Selenic Acids. BY JAMES F. NORRIS AND HENRY FAY. *Am. Chem. J.*, 18, 703–706.—It is shown that selenious acid can be titrated with sodium thiosulphate, one molecule of the former being equivalent to four of the latter. Definite portions of pure selenious acid, which had been resublimed in the presence of a small quantity of nitric acid, were treated in ice-cold solution with an excess of sodium thiosulphate in the presence of enough hydrochloric acid to set free all of the thiosulphuric acid; and the excess of sodium thiosulphate was found by titrating back with iodine. An excess of hydrochloric acid may be used, provided the solution is kept cold. For the determination of selenic acid measured portions were treated with 25 cc. concentrated hydrochloric acid, and the solution was diluted to 100 cc. The solution is boiled for one hour, precautions being taken not to allow the volume to fall below 75 cc.; it is then cooled, diluted with ice-water, and the selenious acid determined by titration. The results of both determinations are accurate; and the method can be used for the determination of a mixture of selenious and selenic acids. The exact nature of the reaction between sodium thiosulphate and selenious acid has not been determined.

W. H. WALKER, REVIEWER.

Separation of Aluminum and Beryllium by the Action of Hydrochloric Acid. BY F. S. HAVENS. *Am. J. Sci.*, 154, 111–

114. The method of Gooch and Havens (*this Rev.*, 3, 30) for the separation of aluminum from iron is here extended with very little variation to the separation of aluminum from beryllium. After removal of the aluminum, the beryllium is determined by evaporating the ether-acid solution to dryness, moistening with strong nitric acid, igniting, and weighing as beryllium oxide.

J. F. NORRIS, REVIEWER.

Combustion of Organic Substances in the Wet Way. BY I. K. PHELPS. *Am. J. Sci.*, **154**, 372–383.—In a former paper (*Am. J. Sci.*, **152**, 70) the author has shown that carbon dioxide can be estimated iodometrically. He has now applied the method to the estimation of carbon in organic substances, the combustion being effected in solution. The carbon dioxide evolved is passed into a standardized solution of barium hydroxide, the excess of which is determined by heating with iodine and titrating the excess of the latter with arsenious acid. One molecule of barium hydroxide is equivalent to one molecule of iodine. Ammonium oxalate, barium formate, and tartar emetic were successfully analyzed in this way when potassium permanganate was used as the oxidizing agent. The carbon in these substances, as well as in phthalic acid, cane-sugar, and paper, was determined by oxidizing with potassium bichromate. The amount of oxygen necessary to oxidize an organic substance was determined by using a known weight of potassium bichromate and estimating the excess of the latter by digesting with hydrochloric acid, absorbing the evolved chlorine in a standard solution of sodium arsenite, and titrating with iodine. Reference must be made to the original article for a description of the apparatus and details of the method.

PROXIMATE ANALYSIS.

W. R. WHITNEY, REVIEWER.

On the Action of Sulfuric Acid upon Strychnine in the Separation of this Alkaloid from Organic Matter. BY E. H. S. BAILEY AND WM. LANG. *Kan. Univ. Quart.*, **6**, 205–207; *Am. J. Pharm.*, 70, 18–21.—The authors have found that the limit of the test for strychnine, in which the color effect produced by potassium bichromate and sulphuric acid is employed, is 0.00025 milligram of the alkaloid. They also found that, if the dry strychnine residue be first heated in the water-bath fifteen minutes with the concentrated acid, before the crystal of bichromate is introduced, the delicacy of the test is reduced to 0.0011 milligram; while in employing a chloroform extraction of the alkaloid from other organic matter, or as nearly as possible, conforming with the test as it is usually applied, a quantity of strychnine less than 0.02 milligram could not be detected. That is, the greatest source of error in the ordinary strychnine determinations lies in incomplete extraction by chloroform.

J. F. NORRIS, REVIEWER.

The Volumetric Determination of the Nitro Group in Organic Compounds. BY S. W. YOUNG AND R. E. SWAIN. *J. Am. Chem. Soc.*, 19, 812–814.—The authors show that a quantitative determination of the nitro groups in dinitrobenzene can be made by reduction with a standardized solution of stannous chloride and titrating the excess of the latter. The method has already been applied to a large number of nitro compounds by Limpricht (*Ber. d. chem. Ges.*, 11, 35, 40).

ASSAYING.

H. O. HOFMAN, REVIEWER.

Fire-Assay for Lead. BY JOHN F. CANNON. *Eng. Min. J.*, 64, 604.—The assay is made as follows: Weigh out 5 grams of ore, place it in a 5-gram crucible containing 20 grams lead flux (16 parts sodium bicarbonate, 16 potassium carbonate, 8 glass borax, 5 flour), mix, tap to settle the mixture, add 20 grams of lead flux, tap, add 4–5 nails, place in a bright-red muffle, fuse in 20–25 minutes, close the muffle when the fusion has become quiet, heat to perfect fluidity, take out the crucible, remove the nails, tapping them to free them from adhering lead, tap the crucible and pour its contents on a level cast-iron plate, stringing out the slag to a thin thread, when even the smallest lead button will be found at the extreme end of the slag. Free the button from slag, hammer out thin on an anvil, and weigh.

The Jones Coupel Moulder. BY THE PARKE AND LACY CO. *Min. Sci. Press*, 75, 357; *Eng. Min. J.*, 64, 521.—This is a device by means of which the bone ash in the coupel mould is compacted by continuous and increasing pressure exerted by a system of levers and toggles worked by a foot-lever.

Corrected Assays. BY E. H. MILLER. *School Mines Quart.*, 19, 43–47.—The author determined the losses in silver occurring with the niter and cyanide methods from assaying an argentiferous galena ore and a dry gold-bearing silver ore, containing some malachite. He found that with the cyanide method silver is carried off in the slags, which is not fully recovered by re-treatment.

TECHNICAL CHEMISTRY.

G. W. ROLFE, REVIEWER.

The Principal Amid of Sugar-Cane. BY EDMUND C. SHOREY. *J. Am. Chem. Soc.*, 19, 881–889.—The author has isolated the characteristic amid of the juice from fifteen samples of sugar-cane and demonstrated that this body is glycocoll (glycocin) and not asparagin, as generally supposed. The differentiation has been carefully worked out by an elaborate comparison of the characteristic reaction of the sugar-cane amid with those of pure glycocoll and asparagin. The formation of hippuric acid by synthesis of this amid with benzoic acid as well as its being a derivative of gelatin is especially significant to animal and vegetable physiology. This paper is important as promising to throw light on the constitution of the proteids.

Crystallization in Motion. BY E. P. EASTWICK, JR. *La. Planter and Sugar Mfgr.*, 20, 43–45.—A very clear exposition of the theory and its application in the production of second sugars. The advantages claimed for the new process over the usual method of boiling " blank" and crystallizing in the "hot-room" are: (1) Increased quantity and better quality of sugar; (2) Decreased quantity and lighter-colored molasses; (3) Reduced cost of building and machinery; (4) Reduced expense of labor; (5) Completion of the production of second sugars by the end of the crop. These advantages are certainly great ones, but it is doubtful whether the statement of the author that the process has gone beyond the experimental stage will be generally accepted.

Crystallization by Motion. BY JOS. E. KOHN. *La. Planter and Sugar Mfgr.*, 20, 45.—The author gives arguments from a theoretical standpoint why crystallization in motion is desirable.

Note on Hydrolysis of Starch by Acids. BY G. W. ROLFE AND GEO. DEFREN. *J. Am. Chem. Soc.*, 19, 679–680.—The authors regret having omitted to refer in their previous article to work on this subject by Prof. H. W. Wiley.

BIOLOGICAL CHEMISTRY.

W. R. WHITNEY, REVIEWER.

Pomegranate Rind. BY HENRY TRIMBLE. *Am. J. Pharm.*, 69, 634–636.—This material has been used to some extent in tanning, and the author finds in the fresh rind 28.38 per cent. tannin. The pure tannin was investigated, and from its composition and chemical properties the author concludes that it is identical with gallotannic acid.

Hemlock Tannin. BY HENRY TRIMBLE. *Leather Manufacturer*, **8**, 88–89.—The percentage of tannin in hemlock bark collected at different seasons, in Pennsylvania and Tennessee, are given. The maximum (calculated for dry bark) is 15.45; the minimum, 8.22. The results of an investigation of the nature of this tannin lead the author to the conclusion that it is identical with oak tannin. The article contains a description of the method employed in obtaining the pure tannin, a brief discussion of the use of the bark extract in tanning, and an illustration showing the structure of a section of the bark, as seen under the microscope.

A Contribution to the Knowledge of the Gum from the Oil Tree. BY CHARLES W. DIRMITT. *Am. J. Pharm.*, **70**, 10–18. —A description of the gum is given (taken from *Bull. Botanical Department, Jamaica*, 4, 77). This is followed by a description of experiments made to fractionate the gum by distillation. Evidently the fractions obtained were the results of decomposition. The analysis of the gum leads the author to the acceptance of the empirical formula $C_{24}H_{40}O_2$. Its iodine number is 46.39 and its saponification equivalent, 15.10.

California and Western Hemlock. BY HENRY TRIMBLE. *Leather Manufacturer*, **9**, 11.—This article describes the structure of the bark of the Tsuga Mertensiana and a tannin determination in it. There was found 11.37 per cent. tannin in the dry bark, and the analysis of this tannin led the author to conclude that it is identical with a large number of oak tannins.

The Caffein Compound in Kola. Part II. Kolatannin. BY J. W. T. KNOX AND A. B. PRESCOTT. *J. Am. Chem. Soc.*, **20**, 34–75.—A résumé of the literature of oak tannins is given. This is followed by a description of methods employed in obtaining kolatannin, and of its properties, and the analyses of several compounds of it with bromine and acetyl, as well as corresponding anhydrides. A discussion of assay methods is given together with comparative results by several of them, which show that the method of the authors is the best.

SANITARY CHEMISTRY.

E. H. RICHARDS, REVIEWER.

Water Supply and Sewerage. BY THE STATE BOARD OF HEALTH OF MASSACHUSETTS (1897). *Ann. Rep.*, **28**, 1–597.— The volume contains the results of the usual monthly examinations of the chief water supplies of the State, together with statistics relating to the experimental filtration of water and sewage.

Report on Food and Drug Inspection. BY C. P. WORCESTER AND C. A. GOESSMANN. *State Board of Health, Mass., Ann. Rep.*, **28**, 601–645.

The City Water Supply. BY ADOLPH GEHRMANN AND CASS L. KENNICOTT. *Rep. Dept. of Health of Chicago for 1897*, 175–214.—The averages of the daily examinations during 1896 of samples from the four pumping stations supplying the city were, in parts per 100,000: Free ammonia, 0.0016; albuminoid ammonia, 0.0074; chlorides (not chlorine), 0.63; bacteria, daily average per cc., 6093; per cent. of times pathogenic bacteria were present, 6.30. On October 23, 1896, a series of samples at one-mile intervals was taken off shore for 12 miles.

	Total solids.	Free ammonia.	Albuminoid ammonia.	Bacteria per cc.
One mile......	14.50	0.0020	0.0140	4000
Twelve miles .	13.00	0.0000	0.0080	520

The highest ammonia was found at three miles; the largest number of bacteria at five miles. A mineral analysis of the water of Lake Michigan is also given.

Sanitary Inspection and Analysis of Ice. BY CASS L. KENNICOTT. *Rep. Dept. of Health of Chicago for 1897*, 215–223.—The method of ice inspection here described must have a marked effect upon the quality of the ice supplied in future. Analyses are given of 61 samples of water from which ice is gathered in the states of Indiana, Illinois, and Wisconsin.

Report of the Rockville Center Laboratory of the Department of Health, Brooklyn. BY HIBBERT HILL AND J. W. ELLMS.—This report gives the results and states some of the conclusions arrived at during an investigation into the sanitary condition of the Brooklyn water supply, extending over a period of twelve months, in order that the fluctuations, seasonal and otherwise, might be studied and their significance might be determined. Although forced by causes beyond individual control to prepare their report in haste, the authors have collected considerable information concerning 16 surface supplies and 13 groups of driven wells. A closely approximate figure for the normal chlorine of this region would seem to be about 0.55, which corresponds with that of other regions near the sea. The identification of a species of myrioplyllum (water milfoil) as a probable cause of a fishy odor, and an indicated relation of the number of bacteria to the degree of pollution of ground waters, are points worthy of note. Certain practical suggestions are made as to the improvement of the quality of the several sources.

Examination of Food Products Collected by the Station. BY A. L. WINTON. *Conn. Agr. Expt. Sta. Ann. Rep.*, **21**, 15–63.—It appears that oysters are frequently treated with borax, from 5.5 to 38 grains in a pint of oysters having been found. 27 out of 42 samples of sausages examined contained from 8.4 to 50.4 grains of borax. The total of 11 samples of salt cod-fish examined also contained considerable amounts, as did three samples of cream. A chemical analysis of date stone coffee is given and results of the examination of some 200 samples of milk.

METALLURGICAL CHEMISTRY.

H. O. HOFMAN, REVIEWER.

Matte-Smelting at the Hall Mines, British Columbia. BY R. R. HEDLEY. *Eng. Min. J.*, **64**, 695–696.—The paper is an illustrated description of the blast-furnace work done at this smeltery. The furnace, 144 by 44 inches at the tuyere-level, puts through in 24 hours nearly 250 tons charge, producing matte with 49 per cent. copper.

The Highland-Boy Mine and Mill, Bingham, Utah. *Eng. Min. J.*, **64**, 665–666.—The mill which started work in September last, combines pan amalgamating and cyaniding, the coarse gold being recovered from the ore by the former process, the fine gold by the latter.

The Modern Gold Chlorination Process for the Treatment of Gold Ores. BY J. E. ROTHWELL. *Min. Sci. Press*, **75**, 573.—A short illustrated description of a chlorinating plant, using the Pearce turret furnace for roasting, and the Rothwell barrel, emphasis being laid more on the practical and economic than on the chemical side of the operations.

Chlorination and Cyaniding. BY C. C. BURGER. *Eng. Min. J.*, **64**, 663.—In comparing barrel-chlorination with cyaniding, the author estimates the cost of chemicals per ton of ore to be from 60 to 70 cents for chlorinating and from 30 to 40 cents for cyaniding, but chlorinating has the advantage of requiring less fine-crushing (14 to 16 mesh *vs.* 30 to 40 mesh) and of giving a higher extraction (90–95 *vs.* 80–85 per cent.). Distance from railroad even does not make chlorinating excessively costly; *e. g.*, at Gibbonsville, Ida., the 20 pounds of chemicals required per ton of ore are hauled 100 miles at 1 cent a pound, and make the additional cost of chlorinating only 20 cents.

Cyaniding Sulphide Gold Ores. BY R. RECKNAGEL. *Eng. Min. J.*, **64**, 580–581.—A paper very general in its character. Among other things the author calls attention to the fact that the gold in some sulphides is soluble, while in others it is insoluble. A very interesting fact is that of iron disulphide; if present as marcasite, it is liable to have a strong decomposing influence upon cyanide, while if present as pyrite this is not likely to be the case, provided, of course, that the sulphide has not been oxidized by atmospheric action. Roasting removes most of the difficulties, if a dead-roast is obtained; a sulphatizing roast, followed by dissolving out the sulphates with water before using the cyanide solution, gives unsatisfactory results as to consumption of cyanide (some sulphate remaining insoluble in water, but acting upon cyanide) and extraction of gold (some sulphide remaining undecomposed).

Some Products Found in the Hearth of an Old Furnace upon the Dismantling of the Trethellan Tin Works, Cornwall. By W. P. Headden. *Proc. Col. Sci. Soc., Nov. 6, 1897.*—The paper contains a number of elementary chemical and microscopical analyses of the products and deductions as to the rational analyses and the way the products were formed.

Kryolith, Its Mining, Preparation, and Utilization. By W. C. Henderson. *J. Franklin Inst.*, 145, 47–54.—The author discusses briefly the properties of the mineral, the history of its discovery, its occurrence, and the methods of mining, shipping, and conversion into soda and alumina. Two grades are produced, one of which, 99 per cent. pure, goes to Copenhagen, and the other, 92 per cent. pure, to Philadelphia, where the Pennsylvania Salt Co. produces, by the Thomsen process, soda and alumina, the latter serving as raw material for the production of alum. Kryolith is also used as a flux in the electrolytic reduction of alumina and in the production of Kryolith glass.

Direct Recarbonizing of Steel from the Blast-furnace. By C. Kirckhoff. *Iron Age*, 60, No. 23, p. 4.—C. H. Foote, W. R. Walker, and E. A. S. Clarke, of the Illinois Steel Co., have succeeded in using spiegeleisen direct from the blast-furnace in recarbonizing steel, the spiegel being taken from the blast-furnace into a mixer, whence it is poured for neutralizing as needed.

REVIEW OF AMERICAN CHEMICAL RESEARCH.

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ARTHUR A. NOYES, Editor; HENRY P. TALBOT, Associate Editor.
REVIEWERS: Analytical Chemistry, H. P. Talbot and W. H. Walker; Biological Chemistry, W. R. Whitney; Carbohydrates, G. W. Rolfe; General Chemistry, A. A. Noyes; Geological and Mineralogical Chemistry, W. O. Crosby; Inorganic Chemistry, Henry Fay; Metallurgical Chemistry and Assaying, H. O. Hofman; Organic Chemistry, J. F. Norris; Physical Chemistry, H. M. Goodwin; Sanitary Chemistry, E. H. Richards; Technical Chemistry, A. H. Gill and F. H. Thorp.

INORGANIC CHEMISTRY.

HENRY FAY, REVIEWER.

On the Cuprosammonium Bromides and the Cuprammonium Sulphocyanates. BY THEODORE WILLIAM RICHARDS AND BENJAMIN SHARES MERIGOLD. *Proc. Am. Acad. Arts Sci.*, 33, 131–138.—Cuprosammonium bromide, $Cu_2Br_2,2NH_3$, was prepared by dissolving cuprous bromide in the least possible amount of ammonium hydroxide and acetic acid, and evaporating over sulphuric acid in a current of hydrogen. It crystallizes in long colorless prisms and is extremely easily oxidized. It is soluble in ammonium hydroxide and nitric acid, but deposits cuprous bromide with other mineral acids. Cuprosammonium sulphocyanate, $Cu_2(SCN)_2,2NH_3$, is precipitated as a white crystalline powder when ammonium sulphocyanate is added to an ammoniacal cuprous bromide solution. It loses ammonia at the ordinary temperature. Tetrammon-cuprosammonium bromide, $Cu_2Br_2,(NH_3)_4$, is prepared by placing dry finely powdered cuprous bromide in a bulb tube packed in ice, and passing in dry ammonia gas until the mass is saturated. The compound is a black powder, extremely unstable. Triammon-cuprosammonium sulphocyanate, $Cu_2(SCN)_2,(NH_3)_3$, is prepared in the same manner as the last mentioned salt and is very unstable, giving up ammonia on exposure to the air. The diammon-cupriammonium sulphocyanate, $Cu(SCN)_2,(NH_3)_4$, was prepared as brilliant blue crystals, by dissolving cupriammonium bromide in a little acetic acid and adding to this a saturated solution of ammonium sulphocyanate, dissolving the precipitate formed in ammonium hydroxide and allowing it to crystallize.

Action of Sulphur on Silicides. Production of Silicon. By G. de Chalmot. *Am. Chem. J.*, 19, 871–877.—Sulphur begins to be absorbed by pulverized copper silicide, when heated in closed tubes, at 200°–250° C., and the absorption is complete at 270°–280°. If the temperature is allowed to rise above 300° C. the reaction $Si + S_2 = SiS_2$ takes place; below 300° C. the copper and sulphur react with the liberation of free silicon. Local action sometimes takes place with production of a small amount of silicon sulphide, but the principal reaction is according to the equation $Cu_2Si + S = Cu_2S + Si$. Free silicon is not liberated from manganese, iron or chromium silicides by sulphur.

Solubility of Lead in Ammonia. By H. Endemann. *Am. Chem. J.*, 19, 890–893.—Lead, when immersed in strong ammonium hydroxide, gradually goes into solution, and after some time the lead becomes covered with a colored coating, the ammonium hydroxide remaining clear and holding in solution after three days' action 0.0139 per cent. of lead. After standing some weeks there is a deposit of hydrated oxide, which contains only a trace of ammonia. Dilute ammonium hydroxide behaves similarly but the separation of hydrated oxide is more rapid. Ammonium bicarbonate does not act upon lead.

A Study of Zinc Hydroxide in Precipitation. By Vernon J. Hall. *Am. Chem. J.*, 19, 901–912.—To determine the action of substances in solution upon the precipitation of zinc hydroxide, the reaction $ZnCl_2 + 2KOH = Zn(OH)_2 + 2KCl$ was studied, using the same methods as were previously applied by the author to the study of the precipitation of ferric hydroxide (*this Rev.*, 3, 135). Precipitations of zinc hydroxide from solutions, each containing the same amount of zinc, were made with two, one and one-half, one, and one-half molecules of potassium hydroxide, and the resulting precipitate and filtrate were analyzed. No chlorine was carried down when two molecules of potassium hydroxide were used, but 7.4 per cent. of the total chlorine was present in the precipitate with one and one-half molecules, and the amount decreases as the proportion of potassium hydroxide decreases. With five and eight molecules of potassium hydroxide no chlorine was carried down. In the same manner the reaction $ZnCl_2 + 2KOH + xK_2SO_4 = Zn(OH)_2 + 2KCl + xK_2SO_4$ was studied. No chlorine is found in the precipitate with two or with one and one-half molecules. Sulphur trioxide was not carried down with two molecules of potassium hydroxide; but 12 per cent. was carried down when one and one-half molecules were used. More zinc oxide is carried down in the presence of potassium sulphate than when it is absent. The effect of concentration is to decrease the quantity of zinc hydroxide precipitated, and to increase the quantity of chlorine carried down. In the case of iron, there is a tendency to decrease the quantity of ferric hydroxide precipitated and the amount of chlorine carried down. Increase of temperature decreases both the amount of metallic oxide and of chlorine which separates from solution.

On the Effect of Light on the Combination of Hydrogen and Bromine at High Temperatures. By J. H. Kastle and W. A. Beatty. *Am. Chem. J.*, **20**, 159–163.—Hydrogen and bromine in sealed glass bulbs heated to 196° C. in the vapor of boiling *o*-toluidine were exposed to the sunlight for varying times and the extent of the combination was noted by observing the change of color of the free bromine. Combination of the gases was effected in the sunlight, but apparently no change was produced by heating in the dark. The results given are only qualitative.

The Constitution of Arsenopyrite. By F. W. Starke, H. L. Shock and Edgar F. Smith. *J. Am. Chem. Soc.*, **19**, 948–952.—By passing dry hydrogen over arsenopyrite it was shown that all of the sulphur could be removed and only traces of the arsenic. Heating in sealed tubes with copper sulphate showed that arsenious acid was always produced. About 30 per cent. of the iron was shown to be present in the ferrous state and 4 per cent. in the ferric state. The facts established may be represented by the formula $14Fe''As'''S.2Fe'''As'''S$, which the authors regard as tentative only.

Some New Ruthenocyanides and the Double Ferrocyanide of Barium and Potassium. By James Lewis Howe and H. D. Campbell. *J. Am. Chem. Soc.*, **20**, 29–33.—The preparation of strontium ruthenocyanide, $Sr_2Ru(CN)_6,15H_2O$, barium potassium ruthenocyanide, $K_2BaRu(CN)_6.3H_2O$, and barium caesium ruthenocyanide, $Cs_2BaRu(CN)_6.3H_2O$, is described, with a crystallographic comparison of barium potassium ferrocyanide and barium potassium ruthenocyanide. Barium potassium ferrocyanide was found to contain three molecules of water and not five, as stated by Wyrouboff. Barium caesium ferrocyanide, $Cs_2BaFe(CN)_6.3H_2O$, is described.

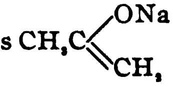
The Action of Sulphuric Acid on Mercury. By J. R. Pitman. *J. Am. Chem. Soc.*, **20**, 100–101.—Sulphuric acid was shaken with mercury at intervals during forty-eight hours, in a nitrometer with and without air, and no decomposition of the sulphuric acid could be detected. Excess of mercury or sulphuric acid was without influence.

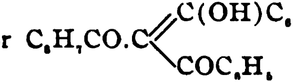
ORGANIC CHEMISTRY.

J. F. NORRIS, REVIEWER.

Anethol and Its Isomers. BY W. R. ORNDORFF, G. L. TERRASSE, AND D. A. MORTON. *Am. Chem. J.*, 19, 845–871.—The chemical properties and molecular weights of anethol and its isomers were studied with the following results: Methylchavicol and estragol are identical and are metamers of anethol. Fluid metanethol has the same molecular weight as anethol, and resembles it in physical and chemical properties closely. The two substances are probably stereoisomers, metanethol being the trans compound, $\begin{matrix}\mathrm{HCC.C_6H_4OCH_3}(p)\\ \|\\ \mathrm{CH_3CH}\end{matrix}$. Anisoïn, the resinous polymeric modification of anethol, acts as a colloid towards the solvents acetic ester, acetone, and benzene. Solid metanethol and the liquid isoanethol have the same molecular weight, which is twice that of anethol. They should be called, therefore, solid and fluid dianethol, respectively. As they both act like saturated compounds, it is possible that they are derivatives of tetramethylene. By heating anethol under pressure to 250°–275° it is transformed into isoanethol, the methyl ester of paracresol, and the methyl ester of parapropylphenol. The author suggests for anethol and its isomers names which are in accord with the new system of nomenclature suggested by the Geneva Conference of Chemists.

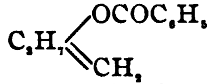
Acetylene Diiodide. BY G. DE CHALMOT. *Am. Chem. J.*, 19, 877–878.—In preparing ethylene tetraiodide by the method of Marquenne (*Bull. Soc. Chim.* [3], 7, 777) using calcium carbide instead of barium carbide, the author obtained acetylene diiodide as a by-product in the alcoholic washings of the crude tetraiodide. When iodine was added to a solution of acetylene in potassium hydroxide, ethylene tetraiodide was not formed, but a white precipitate, which crystallized from benzene in needles having a very pungent odor. The analogous bromine compound is an oil which takes fire spontaneously in the air. No analyses of the compounds are given.

The Action of Sodium upon Methylpropylketone and Acetophenone. BY PAUL C. FREER AND ARTHUR LACHMAN. *Am. Chem. J.*, 19, 878–890.—Freer has investigated the action of sodium on acetone (*Am. Chem. J.*, 12, 155; 13, 319; 15, 582; 17, 1) and on acetaldehyde (*Ibid*, 18, 552; *this Rev.*, 3, 8) and has shown that the behavior of the salts formed indicates that they have the structures  $\mathrm{CH_3C}\!\left\langle\begin{matrix}\mathrm{ONa}\\ \mathrm{CH_2}\end{matrix}\right.$ and $\mathrm{CH_2{=}CHONa}$, respectively. The present paper contains the results of a study of the action of sodium on methylpropylketone, acetophenone, and mesityl oxide. The method employed was the one introduced during the study of sodium acetaldehyde, namely, the combined action of the ketone and benzoyl chloride upon sodium suspended in ether. When an ethereal solution of methylpropylketone was treated with sodium, hydrogen was evolved, and a white precipitate was formed, which was probably not a definite individual, although the result of an analysis indicated the composition C_5H_9ONa. By the action of a mixture of benzoyl chloride and methylpropylketone on sodium suspended in ether, a number of compounds were formed. These were separated as follows: The ether was shaken with water to remove the yellowish solid formed, and then with dilute alkali. When the combined aqueous extracts were acidified, a large quantity of benzoic acid separated, together with a trace of an undetermined fatty acid, and a solid polyketone. The latter compound is a dibenzoyl derivative, colors ferric chloride intensely red, dissolves in alkalies and carbonates, and has, consequently, the structure $H.C_3H_7CO.C(COC_6H_5)_2$ or

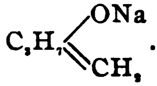


$C_3H_7CO.C\begin{matrix} \diagup C(OH)C_6H_5 \\ \diagdown COC_6H_5 \end{matrix}$.

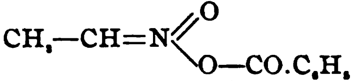
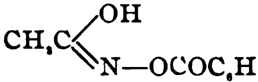
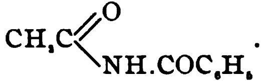
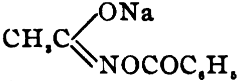
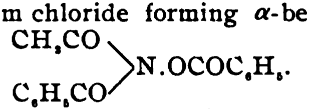
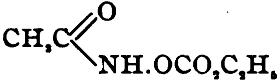
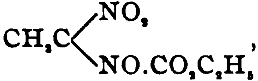
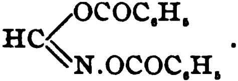
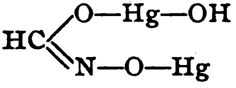
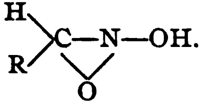
When the ethereal residue, which contained the main products of the reaction, was distilled under diminished pressure, a large amount of tar was formed. The distillate was repeatedly refractionated without being separated into any definite compounds. From the products of the saponification of the different fractions it was shown that isoketone benzoate,

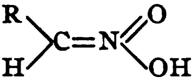


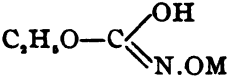
$C_3H_7\begin{matrix} \diagup OCOC_6H_5 \\ \diagdown CH_2 \end{matrix}$, and methylpropylcarbinolbenzoate were present. All of the fractions contained chlorine, which could not be removed by distillation over sodium or by heating with alcoholic potash. As benzoyl chloride is not an active chlorinating agent, the formation of these halogen compounds is best explained by assuming the addition of the chloride to the sodium derivative of the ketone, and the subsequent elimination of hydrochloric acid, which unites with the unsaturated isoketone benzoate. The experimental results are in accord with this application of Nef's hypothesis. Since from the above it appears that the action of benzoyl chloride upon sodium methylpropylketone is similar to that with sodium acetone, and since the solid dibenzoylketone contains its benzoyl groups attached to methyl, sodium methylpropylketone has the structure



$C_3H_7\begin{matrix} \diagup ONa \\ \diagdown CH_2 \end{matrix}$. The action of a mixture of acetophenone and benzoyl chloride on sodium was studied in the way outlined above. From the alkaline extract tribenzoylmethane was obtained, and from the ethereal solution a thick tarry mass, which was shown to contain the benzoate of tribenzoylmethane. A portion of the tar, when saponified by heating with sulphuric acid, yielded benzoic acid, acetophenonepinacone, and a ketone containing halogen, which was not investigated. Acetophenone thus shows the same behavior towards sodium in the presence of benzoyl chloride, as is manifested by acetone and methylpropylketone, with the exception that no isoketone benzoate is formed. It seems, therefore, that as the negative character of the ketone increases the tendency to form O-derivatives decreases. Mesityl oxide forms an unstable sodium compound, which reacts with benzoyl chloride forming a tarry mass which could not be investigated.

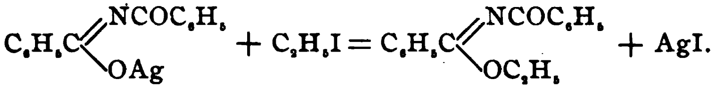
On Salts of Nitroparaffins and Acylated Derivatives of Hydroxylamine. By Lauder W. Jones. *Am. Chem. J.*, **20**, 1–51.—When benzoyl chloride reacts with sodium isonitroethane the metal is first replaced by benzoyl, and a compound of the following structure is formed:  $CH_3{-}CH{=}N\begin{smallmatrix}\diagup O \\ \diagdown O{-}CO.C_6H_5\end{smallmatrix}$. This substance cannot be isolated, but is immediately converted by intramolecular oxidation into the benzoyl ester of acethydroxamic acid, which exists in two forms with the probable structures  $CH_3C\begin{smallmatrix}\diagup OH \\ \diagdown N{-}OCOC_6H_5\end{smallmatrix}$ and  $CH_3C\begin{smallmatrix}\diagup\!\!\diagup O \\ \diagdown NH.COC_6H_5\end{smallmatrix}$. Being a stronger acid than isonitroethane, the hydroxamic ester immediately reacts with the isoparaffin salt, regenerating nitroethane, and forming the sodium salt of the benzoyl ester of acethydroxamic acid,  $CH_3C\begin{smallmatrix}\diagup ONa \\ \diagdown NOCOC_6H_5\end{smallmatrix}$. In the presence of benzoyl chloride, this salt reacts just as the synthetic salt was found to act, namely, in two ways: by direct replacement forming dibenzoylacethydroxamic ester, and by addition and subsequent elimination of sodium chloride forming α-benzoyl-β-acetylbenzoylhydroxylamine,  $\begin{smallmatrix}CH_3CO\diagdown \\ C_6H_5CO\diagup\end{smallmatrix}N.OCOC_6H_5$. The formation of the latter compound throws some light on the triacylated hydroxylamine derivatives in general, and is the first experimental evidence in favor of the suggestion that one of the three isomers corresponds to a true hydroxylamine type. By the action of chlorcarbonic ester on sodium isonitroethane, carbon dioxide and a neutral oil, which could not be purified, were obtained. As it was expected that this reaction would give the carbethoxyl ester of acethydroxamic acid,  $\mathrm{CH_3C}\left\langle\begin{matrix}\mathrm{O}\\ \mathrm{NH.OCO_2C_2H_5}\end{matrix}\right.$, and the carbethoxyl ester of ethylnitrolic acid,  $\mathrm{CH_3C}\left\langle\begin{matrix}\mathrm{NO_2}\\ \mathrm{NO.CO_2C_2H_5}\end{matrix}\right.$, these substances were prepared and subjected to destructive distillation and the action of a number of reagents. Since the results were identical with those obtained when the above oil was studied in the same way, it is probable that the latter contained the two esters. The action of benzoyl chloride on sodium isonitromethane seems to proceed in two ways, depending on whether the salt is alcohol-free or not. In both cases, however, the chief product is a neutral oil, and the reaction is, in part, analogous to that between benzoyl chloride and sodium isonitroethane. Sodium chloride is eliminated and the resulting product is converted by oxidation into the benzoyl ester of formhydroxamic ester. From this the sodium salt is formed by the decomposition of sodium isonitromethane, and the former then reacts with benzoyl chloride by direct replacement exclusively, giving the benzoyl ester of benzoylformhydroxamic acid,  $\mathrm{HC}\left\langle\begin{matrix}\mathrm{OCOC_6H_5}\\ \mathrm{N.OCOC_6H_5}\end{matrix}\right.$. The reaction was shown to proceed as outlined above by effecting the synthesis of the sodium salt of formhydroxamic acid and studying its reaction with benzoyl chloride. By the action of mercuric chloride on sodium isonitromethane a mercuric salt is formed which is converted, probably, into a salt of a hydroximic acid. This salt immediately loses water, giving rise to mercuric fulminate. At the same time by the further action of mercuric chloride on the salt of the hydroximic acid, a basic salt is formed with probable structure  $\mathrm{HC}\left\langle\begin{matrix}\mathrm{O{-}Hg{-}OH}\\ \mathrm{N{-}O{-}Hg}\end{matrix}\right.$. With dilute hydrochloric acid mercuric fulminate is formed. The author comes to the conclusion that the cases of intramolecular oxidation observed in this research, as well as those reported by Nef, cannot be explained on the assumption that the nitroparaffins have the structure proposed by Hantzsch,  The open formula, however,


$$\underset{H}{\overset{R}{>}}C{=}N\underset{OH}{\overset{O}{<}}$$
is in accord with all the facts. In the second part of the paper efforts to prepare derivatives of the oxime of carbon dioxide are described. For this purpose the salts and esters of carbethoxyhydroxamic acid were prepared and studied. If they have the formulæ usually assigned to them,


$$C_2H_5O{-}C\underset{N.OM}{\overset{OH}{<}}$$
, it seemed possible that they would lose alcohol and thus give rise to the salts of the oxime desired. By the action of methyl iodide on the potassium salt of carbethoxyhydroxamic acid, the methyl ester of the acid and α-methyl-β-methylcarbethoxyhydroxylamine were formed. When decomposed by hydrochloric acid, the former gave α-methylhydroxylamine hydrochloride, and the latter α-dimethylamine hydrochloride. By the action of ethyl iodide on the salt of carbethoxyhydroxamic acid analogous compounds were obtained. The ethyl ester reacted with phosphorus pentachloride; hydrochloric acid and ethyl chloride were evolved, and an oily product was formed which decomposed when poured into water, giving α-ethylhydroxylamine hydrochloride. As it is probable that an ester of the oxime of carbon dioxide was formed in this reaction, it is being studied further. The benzyl and benzoyl esters of carbethoxyhydroxamic acid were prepared, and from the former α-benzylhydroxylamine hydrochloride was formed by decomposition with hydrochloric acid.

The Action of the Halogens on the Aliphatic Amines and the Preparation of their Perhalides. By JAMES F. NORRIS. *Am. Chem. J.*, 20, 51–64.—The compounds described by Remsen and Norris (*this Rev.*, 2, 12), formed by the action of bromine and iodine on dimethyl and trimethylamine have been further studied, and it is shown by a number of reactions that the bromides are perhalides containing one added halogen, the trimethylamine compound having the formula $(CH_3)_3NHBr.Br$. The iodine derivative of trimethylamine is a direct addition-product, and has the structure previously assigned to it $(CH_3)_3N.I_2$. By the action of the chlorides of iodine, iodine bromide, and bromine chloride on trimethylamine, perhalides were formed containing two halogens. Analogous compounds were prepared from dimethylamine by the action of the halogens on the salts of the amine. Perbromides of the general structure $R_3NHBr.Br$ were prepared from dimethyl, trimethyl, diethyl, triethyl, dipropyl, tripropyl, and diamylamines. As the number of carbon atoms increased, the stability of the compound and their crystallizing power decreased. No perbromides of primary amines could be isolated.

On Acylimido Esters. BY H. L. WHEELER, P. T. WALDEN, AND H. F. METCALF. *Am. Chem. J.*, 20, 64–76. In a previous paper (*this Rev.*, 3, 60) it was shown that imidomethyl and ethyl benzoates give acyl derivatives with acetyl and benzoyl chloride. The authors have since found that the acylimido esters can also be prepared from the silver salts of the diacyl amides. As silver dibenzamide gave with ethyl iodide a product identical with that obtained from benzimidoethyl ester and benzoyl chloride, the reaction takes place as follows:



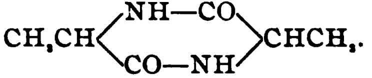
$$C_6H_5C\begin{matrix}\nearrow NCOC_6H_5\\ \searrow OAg\end{matrix} + C_2H_5I = C_6H_5C\begin{matrix}\nearrow NCOC_6H_5\\ \searrow OC_2H_5\end{matrix} + AgI.$$

The isomeric nitrogen ethyl compound, $(C_6H_5CO)_2NC_2H_5$, was prepared from ethyl benzamide and found to have properties different from those of the acylimido ester. It is shown by this reaction that the metal in the silver salts of diacyl amides is joined to oxygen and that they have, therefore, structures analogous to those of the silver salts of monoacylamides and anilides. The acylimido esters are very reactive substances: with water, in the presence of acids, they decompose forming either an alcohol and a diacylamide or a monoacylamide and an ester. Acetyl, propionyl, butyryl, carbethoxyl, and benzoylbenzimido esters form diacylamides, while benzoylphenylacetimido ester and those imido esters containing the group —$COCO.OC_2H_5$ give monoacylamides when decomposed by water. These reactions show that diacyl amides have both acyl groups joined to nitrogen. When benzoylbenzimidoethyl ester was heated with benzoyl chloride tribenzamide was formed; when it was heated in a stream of dry ammonia the decomposition-products were phenyl cyanide, phenyl cyanurate, benzamide, and alcohol. Acylamidines were produced by the action of ammonia or bases on the acylimido esters. Acetyl chloride reacts violently with compounds having the grouping $RC\begin{matrix}\nearrow NR'\\ \searrow OR''\end{matrix}$. As this arrangement exists in the formula usually assigned to the trimethyl ester of normal cyanuric acid, its behavior with acetyl chloride was studied. The ester was crystallized from the chloride without change. The following compounds are described: The picrate of benzimidomethyl ester, benzoyl-, carbethoxyl-, and ethyloxalylbenzimidomethyl esters, benzimidoethyl ester mercuric chloride, acetyl-, propionyl-, normal butyryl-, benzoyl-, and ethyloxalylbenzimido ethyl esters, normal butyrylbenzamide, tribenzamide, ethyldibenzamide, propionylbenzamide, benzimidopropyl ester, acetyl- and benzoylbenzimidopropyl ester, benzoylbenzimidoisobutyl ester, phenylacetimidomethyl ester, and benzoylphenylacetimidoethyl ester.

Note on Double Salts of the Anilides with Cuprous Chloride and Cuprous Bromide. By William J. Comstock. *Am. Chem. J.*, 20, 77–79.—A double salt of the formula $(C_6H_5NH.COCH_3)_2HCl.CuCl$ was formed by cooling a hot solution of acetanilide and cuprous chloride in a mixture of acetic and hydrochloric acids. It crystallizes from alcohol in long, colorless prisms, and is stable in dry air. Analogous bromides containing acetanilide and parabromacetanilide were prepared. Formyl compounds give similar double salts which are very unstable. The salt containing formparatoluide, however, was analyzed and had the formula $(CH_3.C_6H_4NHCHO)_2HBr.2CuBr$.

Action of the Anhydride of Orthosulphobenzoic Acid on Dimethyl- and Diethylaniline. By M. D. Sohon. *Am. Chem. J.*, 20, 127–129.—Dimethylanilinesulphonphthaleïn was formed by heating a mixture of dimethylaniline, the anhydride of orthosulphobenzoic acid, and phosphorus oxychloride on the water-bath. It forms a blue-black brittle mass, slightly soluble in hot water. The aqueous solution dyes silk and wool bright blue. Phosphorus pentachloride, reducing agents, acetic anhydride, or bromine in glacial acetic acid solution do not affect the phthaleïn. An analogous compound was prepared from diethylaniline.

The Molecular Weight of Lactimide. By G. W. Richardson and Maxwell Adams. *Am. Chem. J.*, 20, 129–133.—The molecular weight of lactimide was determined from the lowering of the freezing-point of its solution in acetic acid. The value found was twice that formerly assigned to it and its formula is accordingly



$$CH_3CH\left\langle\begin{matrix}NH—CO\\CO—NH\end{matrix}\right\rangle CHCH_3.$$

The Action of Sodium Ethylate upon α,β-Dibromhydrocinnamic Ester, Citradibrompyrotartaric Ester, and α,β-Dibrompropionic Ester. By Virgil L. Leighton. *Am. Chem. J.*, 20, 133–148.—A 20 per cent. excess (over 2 molecules) of sodium ethylate in alcoholic solution acts upon α, β-dibromhydrocinnamic ester to form mostly β-ethoxycinnamic ester, with a small quantity of unsymmetrical diethoxyphenylpropionic ester. The ethoxy group was shown to be in the β-position in the former ester by the action of hydrochloric acid which gave benzoylacetic acid. When heated to 110°, β-ethoxycinnamic ester decomposed into carbon dioxide and acetophenone. From the acid the silver and calcium salts were prepared. Diethoxyphenylpropionic acid could not be obtained from its ester by saponification as it decomposed, forming benzoylacetic acid. A 20 per cent. excess of sodium ethylate acts upon citradibrompyrotartaric ester forming ethoxycitraconic ester and diethoxypyrotartaric ester, which was shown to be a secondary product of the reaction, formed by the action of sodium ethylate on ethoxycitraconic ester. The former reaction-product gave carbon dioxide and propionylformic acid when boiled with a 10 per cent. solution of sulphuric acid. Ethoxycitraconic acid and a number of its salts were prepared. The reactions of the diethoxypyrotartaric ester obtained towards phenylhydrazine, dilute sulphuric and hydrochloric acids are evidence that it has the symmetrical structure. The silver and lead salts of diethoxypyrotartaric are well characterized. From the experiments with α,β-dibrompropionic ester no satisfactory conclusions could be drawn.

On Some Bromine Derivatives of 2,3-Dimethylbutane. By H. L. Wheeler. *Am. Chem. J.*, 20, 148–153.—A tribrom derivative of 2,3-dimethylbutane could not be prepared from 2,3-dibrom-2,3-dimethylbutane by the action of one molecular quantity of bromine alone or in the presence of iron. In both cases 2,3,K^2,K^3-tetrabrom-2,3-dimethylbutane resulted. As a small amount of impurity has a marked effect on the melting-point of this substance, it is probable that the tetrabromides of 2,3-dimethylbutane already described are identical with the above. One molecular quantity of alcoholic potassium hydroxide gives with the dibromide a mixture of 2,3-dimethyl-1,3-butadiën, $CH_2{=}C(CH_3){-}C(CH_3){=}CH_2$ and unchanged bromide. The unsaturated hydrocarbon unites with bromine forming the tetrabromide. 1,2-dibrom-2-methylpropane was prepared by warming isobutyl bromide with iron and the calculated quantity of bromine.

Alkyl Bismuth Iodides and Bismuth Iodides of Vegetable Bases. By Albert B. Prescott. *J. Am. Chem. Soc.*, 20, 96–100.—The precipitates formed by Dragendorff's reagent for alkaloids (potassium bismuth iodide) in solutions of salts of tetramethylammonium, pyridine, atropine, brucine, and strychnine were analyzed and found to be stable double salts of the general formula $3(\text{Base} + HI).Bi_2I_6$, with the exception of the tetramethylammonium compound which had the composition $N_3(CH_3)_{11}HBi_2I_7$, and the atropine salt whose formula may be as above or $C_{17}H_{23}NO_3.HI.BiI_3$. It is shown that Dragendorff's reagent has no advantage over that of Mayer in the estimation of alkaloids.

Salts of Dinitro-α-Naphthol with Various Metallic Bases. By T. H. Norton and H. Loewenstein. *J. Am. Chem. Soc.*, 19, 923–927.—The preparation and properties of the lithium, magnesium, zinc, and copper salts of dinitro-α-naphthol are described. The solubilities of the ammonium and calcium salts in water, alcohol, and ether are also given.

On Certain Amine Derivatives of Dinitro-α-Naphthol and its Chlorination. By T. H. Norton and Irwin J. Smith. *J. Am. Chem. Soc.*, 19, 927–930.—The trimethylamine, aniline, orthotoluidine, and dimethylaniline salts of dinitro-α-naphthol are described. By the action of chlorine on the dry phenol a substance was obtained which could not be purified but was free from nitrogen.

Carbon Compounds used in Medicine, Classified According to Chemical Structure. By Marston Taylor Bogert. *School of Mines Quart.*, 19, 47–88.—This is the first paper of a series to be published under the above title. The properties and applications of the methane derivatives used in medicine are described.

MINERALOGICAL AND GEOLOGICAL CHEMISTRY.

W. O. CROSBY, REVIEWER.

Mineralogical Notes on Cyanite, Zircon, and Anorthite from North Carolina. By J. H. Pratt. *Am. J. Sci.*, 155, 126–128. These notes are chiefly crystallographic; but a single analysis of the feldspar is given, which identifies it as an anorthite.

Four New Australian Meteorites. By Henry A. Ward. *Am. J. Sci.*, 155, 135–140.—These are typical siderites; and although representing independent and rather widely separated falls, the analyses disclose a marked uniformity of composition, especially as regards the proportions of iron and nickel.

On Rock Classification. By J. P. Iddings. *J. Geol.*, 6, 92–111.—This is a general discussion of the principles of rock classification, as applied to the igneous rocks, and with special reference to the chemical composition and relations of the rocks. No fewer than 928 chemical analyses of igneous rocks are compared graphically as regards: first, the silica; second, the ratio between the silica and alkalies; and third, the ratio between the alkalies, potash and soda. These comparisons lead to various interesting results, one of which is that the variations in all of the chemical constituents, other than silica, must increase in proportion as silica decreases; from which it follows that the number of different kinds of rocks possible for any given percentage of silica is much greater the lower the percentage of silica. The chemical relations of genetically connected series of rocks are next discussed, and various other topics, the general conclusion being that a systematic classification of all kinds of igneous rocks based, as it should be, upon their material characters, cannot properly be expected to take cognizance also of the laws governing their production, eruption, modes of occurrence, and solidification, as well as their subsequent alteration.

Nodular Granite from Pine Lake, Ontario. BY FRANK D. ADAMS. *Bull. Geol. Soc. Am.*, 9, 163–172.—The nodules, which the author regards as a product of the primary magmatic differentiation of the granite, are composed chiefly of quartz, muscovite, and sillimanite ; and the chief peculiarity which they present lies in the fact that the portion of the magma which thus separated out was more acid than the magma as a whole, which is very unusual. The analyses show that although the granite is a very acid one, the chief difference between it and the nodules is that the latter are richer in silica and alumina and poorer in alkalies than the granite itself.

The Phosphate Deposits of Arkansas. BY JOHN C. BRANNER. *Trans. Am. Inst. Min. Eng.*, 26, 580–598.—This detailed account of these, as yet, unworked deposits is accompanied by numerous analyses of the nodular phosphate rock, the amount of phosphoric acid ranging from 22.62 to 33.86 per cent. Two analyses of the black and green Eureka shales, with which the phosphate rock is invariably associated, are also given.

An Olivinite Dike of the Magnolia District (Colorado) and the Associated Picrotitanite. BY MILTON C. WHITAKER. *Proc. Col. Sci. Soc.*, Feb. 5, 1898, 1–14.—Two analyses of this highly altered olivine rock are given, their most striking features being the low percentages of silica (22.24 and 21.90) and the relatively high percentages of màgnesia, carbon dioxide, and the alkalies. The secondary and accessory minerals include serpentine, magnetite, picrotitanite, garnet, calcite, chlorite and micas. The picrotitanite or magnesia menaccanite is the most interesting of these, and three analyses of it by different methods are given and discussed.

Phosphatic Chert. BY J. H. KASTLE, J. C. W. FRAZER, AND GEO. SULLIVAN. *Am. Chem. J.*, 20, 153–159.—One of the most characteristic formations in central Kentucky is a deposit of chert which marks the upper boundary of the Trenton limestone. The limestone immediately below the chert is characterized by thin layers which are highly phosphatic, containing from 1.46 to 31.815 per cent. of phosphoric acid, P_2O_5, the average being about 15.9 per cent.; and this rock is probably the source of the remarkable and enduring fertility of the soil of the Blue Grass section. It has more recently been discovered that the chert itself is invariably phosphatic; and 39 analyses are given, showing from 0.179 to 3.5 per cent. of P_2O_5, with an average of 1.684 per cent. Other analyses are quoted to show that the chert contains four or five times as much P_2O_5 as the normal Trenton limestone or the soils derived from it. Cherts from the Birdseye limestone and from the Permian limestone of Russia were also analyzed and found to contain 0.5 to 3 per cent. of P_2O_5. Other analyses tend to show that the phosphate is an original feature of the chert, while the fact that the porous, weathered cherts are most highly phosphatic suggests that the phosphate may be the insoluble residue of limestone which was once intimately associated with the chert. A chert breccia is also described, the dark-brown cementing substance of which gave in four analyses from 3 to 4.5 per cent. of P_2O_5, which is supposed to exist in the rock as phosphate of iron.

[CONTRIBUTION FROM THE MASSACHUSETTS INSTITUTE OF TECHNOLOGY.]

REVIEW OF AMERICAN CHEMICAL RESEARCH.

VOL. IV. No. 5.

ARTHUR A. NOYES, Editor; HENRY P. TALBOT, Associate Editor.
REVIEWERS: Analytical Chemistry, H. P. Talbot and W. H. Walker; Biological Chemistry, W. R. Whitney; Carbohydrates, G. W. Rolfe; General Chemistry, A. A. Noyes; Geological and Mineralogical Chemistry, W. O. Crosby; Inorganic Chemistry, Henry Fay; Metallurgical Chemistry and Assaying, H. O. Hofman; Organic Chemistry, J. F. Norris; Physical Chemistry, H. M. Goodwin; Sanitary Chemistry, E. H. Richards; Technical Chemistry, A. H. Gill and F. H. Thorp.

GEOLOGICAL CHEMISTRY.

W. O. CROSBY, REVIEWER.

Geology of Canada. *Ann. Rep. Geol. Survey, Can.*, 7, (1894).—In the section by F. D. Adams on the Laurentian north of the St. Lawrence river, are given the analyses which were made to establish a criterion for the distinction of gneisses of igneous and sedimentary origin. These analyses formed the basis of a separate paper in the *Am. J. Sci.* (July, 1895), which has been reviewed in these pages. Under the head of Economic Resources are also several analyses of iron ores. The section by G. Christian Hoffman, on Chemistry and Mineralogy, consists chiefly of miscellaneous analyses of a large variety of minerals, including coals, iron ores, celestite, graphite, galenite, tetrahedrite, nickeliferous pyrrhotite, marls, mineral waters, and many assays of gold and silver ores.

GENERAL AND PHYSICAL CHEMISTRY.

A. A. NOYES, REVIEWER.

A Revision of the Atomic Weight of Zirconium. BY F. P. VENABLE. *J. Am. Chem. Soc.*, 20, 119–128.—The ratio $ZrOCl_2.3H_2O : ZrO_2$ was determined by heating the former substance at 100° in a current of hydrochloric acid to a constant weight and igniting it, first gently and then to the highest heat of the Bunsen burner for three or four days. The mean value of the atomic weight found is 90.78, that given by Clarke in his report of last year being 90.40. Five sources of error possibly affecting the results are considered by the author. The drying of the hydrated salt seems to the reviewer to introduce another element of uncertainty; for it is almost incredible that a salt which is known to lose water at 180°–210° should not undergo an appreciable loss when heated at 100° for 50–100 hours. It would be desirable to show, at least, that the weight on drying not only became constant, but remained so on long-continued heating.

Fifth Annual Report of the Committee on Atomic Weights. Results Published during 1897. By F. W. Clarke. *J. Am. Chem. Soc.*, **20**, 163–173.—The following is a summary of the atomic weight determinations (referred to oxygen as 16.00) published during last year. The values given by the author in his previous report are also appended in parentheses: Carbon, (Scott, *J. Chem. Soc.*, **71**, 550), 12.0008 (12.01); Carbon, (Lord Rayleigh, *Chem. News*, **76**, 315), 11.9989 (12.01); Nitrogen, (Leduc, *Compt. rend.*, **125**, 299), 14.005 (14.04); Aluminum, (Thomsen, *Ztschr. anorg. Chem.*, **15**, 447), 26.992 (27.11); Nickel, (Richards and Cushman, *Proc. Amer. Acad.*, **33**, 97), 58.69 (58.69); Cobalt, (Richards and Baxter, *Proc. Amer. Acad.*, **33**, 115), 58.99 (58.93); Cerium, (Wyrouboff and Verneuil, *Bull. Soc. Chim.*, **17**, 679), 139.35 (140.2). The article of Scott on carbon related to the application of a correction to the determinations of previous investigators for the change in volume which potash undergoes when it absorbs carbon dioxide. Work has also been done by Hardin (*J. Am. Chem. Soc.*, **19**, 657) on the atomic weight of tungsten, showing the unreliability of the method usually employed.

Investigation of the Theory of Solubility Effect in the Case of Tri-ionic Salts. By Arthur A. Noyes and E. Harold Woodworth. *J. Am. Chem. Soc.*, **20**, 194–201; *Tech. Quart.*, **11**, 65–71.—It was found that the solubility of lead iodide is diminished both by potassium iodide and by lead nitrate in such a way that the product of the concentration of the lead ions into the square of the concentration of the iodine ions remains constant, thus confirming the applicability of the mass-action law to the solubility of tri-ionic salts. The concentration of the saturated solutions was determined by conductivity measurements.

The Relation of the Taste of Acids to their Degree of Dissociation. By Theodore William Richards. *Am. Chem. J.*, **20**, 121–126.—The author finds that he can just detect, by tasting, the acidity of a nearly one-thousandth normal hydrochloric acid solution, and can distinguish weak solutions differing from one another in concentration by 25 per cent.; and he shows that tenth-normal acid can be titrated with alkali with an error of less than one per cent., using the sense of taste as an indicator of neutrality. The sour taste of different acids was not found to be proportional to their degree of dissociation; for example, a 0.001 normal hydrochloric acid had a taste like that of an acetic acid solution three times as strong, although the concentration of the hydrogen ions in the former solution is about five times as great as in the latter solution. It was further found that, in accordance with the laws of mass-action, sodium acetate greatly diminished the sour taste of acetic acid, though not as much as the theory requires, while potassium chloride has no influence on that of hydrochloric acid.

A Redetermination of the Atomic Weight of Zinc. BY H. N. MORSE AND H. B. ARBUCKLE. *Am. Chem. J.*, 20, 195–202. —Richards and Rogers (*Proc. Am. Acad.*, **28**, 200) having shown that an error exists in those atomic weight determinations where zinc oxide has been weighed owing to its occlusion of nitrogen and oxygen, the authors have repeated the earlier determinations of Morse and Burton, using the same sample of pure zinc, and determining the quantities of these gases occluded by dissolving the zinc oxide after weighing, in dilute sulphuric acid, and measuring and analyzing the gas evolved. The mean value of the atomic weight found without correcting for the occluded gases is 65.328; the corrected value is 65.457. The value found by Richards by the analysis of zinc bromide was 65.40.

Ternary Mixtures, III. BY WILDER D. BANCROFT. *J. Phys. Chem.*, 1, 760–765.

Molecular Weights of Some Carbon Compounds in Solution. BY CLARENCE L. SPEYERS. *J. Phys. Chem.*, 1, 766–783.—The article presents the results of a large number of determinations of the rise in boiling-point produced by various organic substances when dissolved in water, methyl alcohol, ethyl alcohol, propyl alcohol, chloroform, and toluene. These solvents were caused to boil at different temperatures by variation of the external pressure, the main object of the investigation being apparently the determination of the effect of temperature on the molecular raising. No discussion of the results is given, however, nor is any evidence of their accuracy presented, which is particularly unfortunate, since, according to the reviewer's experience, a Beckmann thermometer which is subjected to considerable variations of pressure, may give quite unreliable readings, owing to the imperfect elasticity of the bulb.

Fractional Crystallization. By C. A. Soch. *J. Phys. Chem.*, **2**, 43–50.—The author has made determinations of the solubility in pure water at 25° and at 80° and in forty per cent. alcohol at 25° of four pairs of salts, the solutions being saturated at the same time with both of the two salts. The salt-pairs investigated were potassium and sodium chlorides, potassium chloride and nitrate, sodium chloride and nitrate, and potassium nitrate and sodium chloride. The article contains in addition readily derived formulæ which express the extent to which a mixture of two salts in a solution saturated with them can be separated by definite processes involving on the one hand crystallization by variation of the temperature and the quantity of solvent present, and on the other, precipitation by alcohol at constant temperature.

Distribution of Mercuric Chlorid between Toluene and Water. By Oliver W. Brown. *J. Phys. Chem.*, **2**, 51–52.—It is shown by experiments that mercuric chloride distributes itself between toluene and water in such a manner that the ratio of its concentrations in the two solvents remains nearly, but not completely, constant. The variations from constancy are believed to be greater than would be accounted for by experimental errors.

Solutions of Silicates of the Alkalies. By Louis Kahlenberg and Azariah T. Lincoln. *J. Phys. Chem.*, **2**, 77–90.—The authors have determined the freezing-points and electrical conductivities of dilute solutions of the neutral and acid silicates of the alkali metals. Their experiments confirm the conclusion previously drawn by Kohlrausch in the case of sodium silicate that these salts are to a great extent broken up in solution into colloidal silicic acid and the alkaline hydroxides, this hydrolysis being complete, according to the freezing-point results, when one mol of the neutral salt is present in 48 liters, and amounting to about 65 per cent. at a dilution of 8 liters. The acid salts investigated, $R'HSiO_3$ and $R'_2Si_5O_{11}$, are somewhat less hydrolyzed, as the Law of Mass Action requires. The authors find that the conductivity of the salts is much less than that of the free bases of corresponding concentration, and that that of the acid salts is less than that of the neutral salts ; and they appear to attribute these facts, and also the decrease of the conductivity of those salts with the concentration, to a retarding influence of the colloidal silicic acid on the movement of the ions. It seems far more probable, however, that these differences are due mainly, if not wholly, to the fact that the hydrolysis is not complete, and varies in the different cases ; for it is not likely that in solutions so dilute as $\frac{1}{16}$ or $\frac{1}{32}$ normal the dissolved substance, whatever its nature, appreciably affects the rate of movement of the ions.

Vapor-tension of Concentrated Hydrochloric Acid Solutions. By F. B. Allan. *J. Phys. Chem.*, **2**, 120–124.—The partial pressure of hydrochloric acid over its solutions containing from 28.1 to 36.4 per cent. acid was determined by drawing measured quantities of air through them, absorbing the gas in water, and titrating. Between these comparatively narrow limits of concentration the partial pressure of the acid was found to vary from 5.5 to 138.1 mm. of mercury, so that the variation cannot possibly be accounted for by the change in dissociation of the acid.

H. M. Goodwin, Reviewer.

A New Form of Discharger for Spark Spectra of Solutions. By L. M. Dennis. *J. Am. Chem. Soc.*, **20**, 1–3.—This device avoids the difficulty usually met with in observing spectra of this kind, namely, spattering and rapid consumption of the solution. It consists of a U-shaped tube of unequal arms, in the shorter of which the lower sparking terminal—a cone of graphite—projects upward, being sealed in from below by means of a platinum wire. The solution is fed to this electrode from the longer arm by the following device: a somewhat smaller straight glass tube which telescopes air-tight through the open end of the longer arm, by means of a rubber connector, is pressed down into the solution until its lower end is at a level with the cone in the shorter arm. As the solution evaporates at the electrode, air enters the longer arm through this tube until the same level of liquid is reestablished in both arms.

A Method of Determining the Resistance of Electrolytes. By Parker C. McIlhiney. *J. Am. Chem. Soc.*, **20**, 206–208.—The method described lays no claim to the degree of accuracy attainable with the usual Kohlrausch method and is of advantage mainly when a large number of resistance measurements are to be made in a short interval of time. It was devised to measure the resistance of silicates and similar electrolytes at high temperatures. The method consists in connecting a known adjustable resistance R, in series with the conductivity cell of resistance X, with a battery of constant electromotive force. A rapidly revolving current reverser is inserted in the circuit between the known resistance and the cell, to avoid polarization and electrolysis in the latter. The fall of potential through the known resistance R is measured by means of a D'Arsonval galvanometer. If R is made small compared with X, the drop of potential through R is approximately proportional to the conductivity of the cell. Formula (5) should be corrected as follows: $f : g = X : R$.

The Jacques Cell. BY WM. OSTWALD. *Am. Electrician*, 10, 16–17.—In this letter to the *Electrician* Ostwald has clearly indicated the probable actions taking place in the Jacques carbon cell, by pointing out its analogy to the Lalande cell, the latter consisting of copper oxide and zinc electrodes in sodium hydrate. On closed circuit the zinc dissolves to sodium zincate, while the cuprous oxide is reduced to metallic copper. The continuous action of the cell requires the reoxidation of the reduced copper by air or oxygen. In the Jacques cell the copper oxide is replaced by iron, which in presence of the free oxygen blown in at the high temperature used, is oxidized to ferric oxide, and the zinc by carbon. The action of the cell consists in the oxidation of the carbon anode to carbonic acid and reduction of the ferric oxide. Oxygen must be supplied at the cathode in order to maintain the action of the cell. The chemical potential of free oxygen is therefore not effective in producing electrical energy in this cell, but only that of ferric oxide. The thermoelectric explanation of Reed is regarded as wholly unfounded.

The Surface-tensions of Aqueous Solutions of Oxalic, Tartaric, and Citric Acids. BY C. E. LINEBARGER. *J. Am. Chem. Soc.*, 20, 128–130.—The surface-tensions of aqueous solutions of the three above-mentioned acids was determined at 17.5°, 15° and 15°, respectively, for various concentrations, with the apparatus devised by the author and previously reviewed (*this Rev.* 2, 38). It was found that the surface-tension of oxalic and citric acid solutions rapidly diminished with increasing concentration, whereas the values for tartaric acid increased. For solutions of citric acid varying in concentration between thirty-five and sixty-five per cent. the surface-tension was nearly constant. No attempt was made to explain the results obtained other than to ascribe them to complicated relations resulting from polymerization and dissociation phenomena.

The Vapor-pressure Method of Determining Molecular Weights. BY W. R. ORNDORFF AND H. G. CARRELL. *J. Phys. Chem.*, 1, 753–760.—This is a preliminary communication on the application of Ostwald's method of determining the vapor-pressure of solutions as worked out by Bredig and Will, to molecular weight determinations. As no essential modifications have been made in the method and as the results published clearly indicate the preliminary nature of the experiments thus far made, a more detailed review may be reserved for a later communication.

Solubility and Boiling-point. BY OLIVER W. BROWN. *J. Phys. Chem.*, 1, 784–786.—The addition of potassium chloride to an aqueous alcoholic solution was found to lower its boiling-point, as already shown by Miller, whereas the addition of a substance which is soluble both in alcohol and water, as urea, was found, as expected, to produce a less anomalous result. The boiling-point was in fact found to rise, but less than in simple aqueous solutions. The experiments are to be continued with alcoholic solutions of different percentage composition.

On the General Problem of Chemical Statics. By P. Duhem. *J. Phys. Chem.*, **2,** 1-43; 91–116.—This paper is, as the author states, intended to be a commentary on and complimentary to Gibbs' memoir "On the Equilibrium of Heterogeneous Substances." On account of its mathematical nature it does not admit of a detailed review. The subject is treated with the author's usual elegance and should be read by all interested in the application of thermodynamics to chemical equilibrium. The following subdivisions of the paper will indicate its general scope and contents. The preliminary chapter treats of the thermodynamic potential of an homogeneous mixture under constant pressure and under constant volume. Chapter 1 deals with general theorems of the chemical statics of homogeneous systems, both at constant pressure and at constant volume; Chapter 2 deals with heterogeneous systems at constant pressures and contains a deduction of the phase rule and an application of it to systems of different variance. The concluding chapter has to do with the general principles of the equilibrium of heterogeneous systems at constant volume, and the more especial discussion of systems of different variance, and under certain prescribed external conditions.

Correction. By Wilder D. Bancroft. *J. Phys. Chem.*, 1, 786.—The fact that lead iodide crystallizes in the anhydrous form from aqueous solutions, instead of with two molecules of water as assumed by the author, renders valueless his conclusions relative to this salt in his paper on solids and vapors (*J Phys. Chem.*, 1, 344).

ANALYTICAL CHEMISTRY.

ULTIMATE ANALYSIS.

H. P. Talbot, Reviewer.

The Dignity of Analytical Chemistry. By C. B. Dudley. *J. Am. Chem. Soc.*, **20,** 81–96.—In this paper (his presidential address), Dr. Dudley has clearly and forcibly stated the claims which Analytical Chemistry may justly put forward for a position of equality with other branches of the science. The article does not admit of a brief review.

Sodium Peroxide in Quantitative Analysis. BY C. GLASER. *J. Am. Chem. Soc.*, 20, 130–133.—The paper reviews the published statements regarding the quantitative use of sodium peroxide, and the author details a procedure involving its successful use in the determination of sulphur in coal, coke, and asphalt.

The Volumetric Determination of Cobalt. BY HARRY B. HARRIS. *J. Am. Chem. Soc.*, 20, 173–185.—A critical examination of the various published volumetric methods for the determination of cobalt has been attempted, from which the author concludes that "after careful repetition of these methods, making varying conditions whenever deemed advisable, one is justified in concluding that none of them possess the degree of accuracy required in any trustworthy determination of cobalt. A good volumetric method for this purpose still remains to be devised." No suggestions are offered to assist the future investigator.

W. H. WALKER, REVIEWER.

The Estimation of Manganese as Sulphate and as the Oxide. BY F. A. GOOCH AND MARTHA AUSTIN. *Am. J. Sci.*, 155, 209–214.—The estimation of manganese in its salts when combined with volatile acids, by weighing as the anhydrous sulphate, is found, contrary to previous investigations, to be both rapid and accurate. The difficulty in obtaining a manganese solution of known strength, owing to the varying degrees of hydration of the manganous salts, was overcome by preparing a perfectly neutral solution of manganous chloride, and from the weight of silver chloride obtained from a definite volume, the weight of manganese present was calculated. Portions of this solution were evaporated to dryness in the presence of sulphuric acid, and the excess of acid driven off by heating the residue in a platinum crucible suspended in a larger porcelain crucible used as a radiator. This outer crucible may be heated to dull redness, and the residue thus ignited to constant weight. The results show the process to be both simple and accurate. The estimation of manganese by weighing as the different oxides is described, but found by experiment to be far less satisfactory than the method just outlined.

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REVIEW OF AMERICAN CHEMICAL RESEARCH.

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ARTHUR A. NOYES, Editor; HENRY P. TALBOT, Associate Editor. REVIEWERS: Analytical Chemistry, H. P. Talbot and W. H. Walker; Biological Chemistry, W. R. Whitney; Carbohydrates, G. W. Rolfe; General Chemistry, A. A. Noyes; Geological and Mineralogical Chemistry, W. O. Crosby; Inorganic Chemistry, Henry Fay; Metallurgical Chemistry and Assaying, H. O. Hofman; Organic Chemistry, J. F. Norris; Physical Chemistry, H. M. Goodwin; Sanitary Chemistry, E. H. Richards; Technical Chemistry, A. H. Gill and F. H. Thorp.

ANALYTICAL CHEMISTRY.

PROXIMATE ANALYSIS.

A. H. GILL, REVIEWER.

A Delicate Test for the Detection of a Yellow Azo Dye used for the Artificial Coloring of Fats, etc. BY J. F. GEISLER. *J. Am. Chem. Soc.*, 20, 110.—The test consists in adding a small quantity of Fuller's earth to the fat, placed in a porcelain dish. A pink or violet color is produced if the dye is present. The test will detect 14 grains per ton or 1 part per million with ease, and may be used to indicate 0.000000005 mg. of the dye.

Method of Testing Spirits of Turpentine. BY C. B. DUDLEY AND F. N. PEASE. *Am. Eng., Car Builder and R. R. J.*, 72, 119.—The four tests employed are: Specific gravity, distillation-point, residue on evaporation, and treatment with oil of vitriol. The gravity is determined by the Westphal balance and varies from 0.862 to 0.872. The distillation-point is determined by boiling 100 cc. in a 500 cc. distillation flask. This point varies from 305° to 308° F. (152°-153° C.) at 29 inches pressure, with the thermometer wholly in the vapor. For the residue on evaporation, 20 grams of the sample are weighed into a 100 cc. platinum dish and evaporated not above 250° F. (121° C.). The residue should not exceed 2 per cent. and usually does not exceed one. The evaporation should take place at 100° C. in cases of dispute. The treatment with oil of vitriol is based upon the fact that pure oil of turpentine is almost wholly polymerized and dissolved by sulphuric acid. Six cc. of the sample are placed in a 30 cc. tube graduated to tenths, held under a cold water faucet and slowly filled with C. P. sulphuric acid. It is allowed to cool, the tube corked, and the contents mixed five or six times, cooling if necessary. The tube is placed vertically and allowed to stand half an hour. The material unaffected by the acid is the adulterant and its volume is measured. It is not usually more than 3 per cent.

G. W. ROLFE, REVIEWER.

The Lecithins of Sugar-cane. BY EDMUND C. SHOREY. *J. Am. Chem. Soc.*, **20**, 113–118.—The paper presents a discussion of the determination of lecithins in sugar-cane juice as well as the limitations of the present analytical methods for separating these bodies from other nitrogen compounds present. The author suggests that the greasy deposits in the higher vacuum cells of multiple effects of sugar houses result in part from the decomposition of lecithins.

Comparison of the Standard Methods for the Estimation of Starch. BY H. W. WILEY AND W. H. KRUG. *J. Am. Chem. Soc.*, **20**, 253–266.—A large amount of experimental data is given which proves that all the existing polarimetric methods for determining starch are unreliable. The Lindet method is only approximate. The diastase method gives satisfactory results providing precautions are taken to pulverize the sample to extreme fineness and allow sufficient time for the action of malt, preferably containing pepsin. It is recommended to remove the fat first and also to repeat the malt treatment after boiling and cooling. While noting that the results of cereal analyses are at best but approximate, the authors do not believe that any constituents are present that are unaccounted for unless amounts of complex carbohydrates so small as to be reasonably negligible.

The Solubility of the Pentoses in the Reagents Employed in the Estimation of Starch. BY W. H. KRUG AND H. W. WILEY. *J. Am. Chem. Soc.*, **20**, 266–268.—The authors show by analyses that the solution of the pentosans by malt extract is inappreciable. Incidentally, they point out the important fact that hexose carbohydrates give a noticeable amount of furfurol when distilled with 12 per cent. hydrochloric acid. This, it would seem, might have an important bearing on many "pentosan" determinations.

Note on Fehling's Solution. BY J. B. TINGLE. *Am. Chem. J.*, **20**, 126–127.—The author recommends the Pavy solution, modified by Purdy, in which the tartrate is replaced by glycerol. The composition is given of the solution which is especially designed for urine analysis.

W. R. WHITNEY, REVIEWER.

A Simple and Accurate Method of Testing Diastatic Substances. BY JOKICHI TAKAMINE. *Am. J. Pharm.*, 70, 141–

143.—This is apparently a rapid method of procedure, based on the assumption that taka-diastase does not lose its diastatic power on standing, as do other forms of this ferment. The diastatic action of the material to be measured is compared with the action of the taka-diastase, the actual comparison being made between the color produced by iodine in starch paste hydrolyzed by the sample ferment and shades, or colors, produced when taka-diastase is used.

Vinegar Analysis and Some Characteristics of Pure Cider Vinegar. BY ALBERT W. SMITH. *J. Am. Chem. Soc.*, **20**, 3–9. —Beside the methods of analysis, this article also states the results of analyses of over fifty different samples of vinegar, the acid, total solids, ash, alkalinity of ash, and the soluble and insoluble P_2O_5 of the ash being given. From these results interesting conclusions are drawn as to differences between pure cider vinegar and other varieties.

Method of Analysis of Licorice Mass. BY ALFRED MELLOR. *Am. J. Pharm.*, 70, 136–137.—This is an outline of the methods adopted by consumers and manufacturers in the United States. Moisture, mineral matter, insoluble matter (in cold water), gummy matter, glycyrrhizin, saccharine matter, and extractive substances are determined.

Glucose in Butter. BY C. A. CRAMPTON. *J. Am. Chem. Soc.*, **20**, 201–207.—In preparing butter for transportation into warm climates it is sometimes the practice to mix glucose with the salted butter. The author has determined the quantities of glucose in different samples "by difference" and by direct methods; *i. e.*, by the use of Fehling's solution and by the optical method. The percentage of glucose found in the samples varies from 5 to 13 per cent. calculated as confectioner's glucose (16.5 per cent. water).

Methods and Solvents for Estimating the Elements of Plant Food Probably Available in Soils. BY WALTER MAXWELL. *J. Am. Chem. Soc.*, **20**, 107–110.—A preliminary publication, to be followed later by descriptions of experiments carried on in Hawaii.

The Determination of Small Quantities of Alcohol. BY FRANCIS G. BENEDICT AND R. S. NORRIS. *J. Am. Chem. Soc.*, **20**, 293–302.—The method is based on the oxidation of alcohol by chromic acid, and presupposes the absence of other reducing agents in the alcoholic solution. The result of an analysis of a solution containing 0.00494 per cent. of alcohol varied by but 0.03 of this amount. With solutions ten times as concentrated the agreement was exact. The paper contains interesting information concerning the absorption of alcohol from air by sulphuric acid.

On the Assay of Belladonna Plasters and the Alkaloidal Strength of the Belladonna Plasters of the Market. By Carl E. Smith. *Am. J. Pharm.*, 70, 182–189.—This is a report of the Research Committee D, Section II of the Committee of Revision of the U. S. Pharmacopœia. It contains a detailed method of analysis, as well as the results of analyses of ten plasters of American and one of foreign make.

Analysis of the Rhizome and Rootlets of Plantago Major, Linne. By J. Frank Strawinski. *Am. J. Pharm.*, 70, 189–191.—The drug was successively extracted with petroleum ether, ethyl ether, absolute alcohol, and water, and these extracts examined. A crystallizable material was found in the petroleum ether extract, which the author hopes to study further. No glucosides or alkaloids were found in the residue resulting from the ether extract. Glucose and saccharose were found in the alcohol extract. Starch was found, but no tannin. The ash, amounting to 24.7 per cent. of the weight of the drug, was found to contain the ingredients usually found in plant ashes.

Criticism of a Proposed Method for the Assay of Senega. By Edward Kremers and Martha M. James. *Pharm. Rev.*, 16, 45–49.—The authors show that the fact that methyl salicylate may be obtained from most samples of senega root by distillation with steam, is not a satisfactory criterion in testing for this drug. Samples known to have been false senega yielded the salicylate, while some true senegas did not. The authors point out the fact that addition of acid in the distillation increases the yield of methyl salicylate, which is evidence that this ester is a product of hydrolysis, perhaps of a glucoside.

Test for Hydrocyanic Acid in Mitchella Repens. By Richard Fischer. *Pharm. Rev.*, 16, 98–99.—The author failed to find this acid in samples of the partridge berry or squaw vine examined by him. The search was prompted by the report that hydrocyanic acid occurs in this plant.

F. H. Thorp, Reviewer.

A Method of Estimating Tannin. By J. N. Hurty. *Leather Manufacturer*, 9, 10.—A ten per cent. solution of the extract is made by dissolving the requisite quantity in 500 cc. boiling water, and, after cooling, diluting with the proper amount of water. After mixing, two samples of 100 cc. each are evaporated on a steam-bath in aluminum dishes, weighed, and the average of weight taken as the total solids. The remainder of the solution is filtered on S. & S. No. 597 paper and the first 100 cc. of the filtrate rejected. Two more samples, each of 100 cc. are evaporated as before and the average of the weighings subtracted from the total solids. The difference is the insoluble matter. Two more 100 cc. samples are run upon two 10 gram portions of hide powder in 100 cc. beakers, well stirred and allowed to stand five minutes; they are then put into glass percolators stoppered with absorbent cotton. The turbid and colored percolates are thrown away and the wet hide powder packed by pressing with a large glass rod. New portions of the filtered extract are then poured through the percolators and 5 cc. portions of the clear liquid are collected and tested with the original filtered extract for soluble hide. If no soluble hide is found, 105 cc. of each percolate is reserved and then 5 cc. more is collected and tested for tannin by adding a few drops of soluble hide solution. If both tannin and soluble hide are absent in the percolates, 100 cc. of the reserved portions are evaporated as before and the average of the weights taken as non-tannins. This weight is subtracted from the total solids from the filtered extract solution and the difference called tannin. The method is claimed to be more rapid than the official "shake process." Several misprints make the directions somewhat obscure.

Testing of Formaldehyde. By Carl E. Smith. *Am. J. Pharm.*, **70**, 86.—The author has studied numerous methods of assaying formaldehyde with the view of finding a simple, rapid, and reasonably accurate process for use by manufacturers and pharmacists. It is necessary that common impurities, such as acetone and methyl alcohol shall not affect the accuracy of the process. The hydroxylamine method of Brochet and Cambier (*Compt. rend.*, **120**, 489) is quick and accurate with pure solutions, but other aldehydes and acetones interfere with its exactness. The iodine method (Romijn, *Ztsch. f. anal. Chem.*, **36**, 18) is unsuitable if acetone is present. The cyanide method of Romijn (*ibid.*) requires much care and attention and will only give satisfactory results in practiced hands. The free alkali method consists in heating formaldehyde with sodium or potassium hydrate solution under pressure, in a manner similar to that in the saponification of esters, converting the formaldehyde into methyl alcohol and formic acid. The results are reasonably exact in all but one case, but methyl alcohol and acetone interfere with the result, and there is some danger of an explosion. One anomalous case was observed, but could not be explained. The ammonia method (Legler, *Ber.*, **16**, 1333) was found reliable if care was taken to standardize the ammonia solution frequently and to titrate the contents of the flask soon after admixture with the ammonia. Methyl alcohol and acetone have practically no influence. The inaccuracy caused by the loss of ammonia led the author to modify the process as follows: Dissolve two grams of pure neutral ammonium chloride in 25 cc. of water and put into a flask provided with a well-fitting stopper. Add 2.25 grams of the sample and run in from a burette 25 cc. of $\frac{n}{1}$ potassium (or sodium) hydrate. Stopper the flask at once and let stand one-half hour. Then add a few drops of rosolic acid solution and determine the excess of ammonia with $\frac{n}{1}$ sulphuric acid, each cc. $\frac{n}{1}$ potassium hydrate consumed indicating 0.5 per cent. of formaldehyde. A series of tests on commercial samples is tabulated and a list of tests to be followed in the examination of them, together with the precautions to be observed, is given.

TECHNICAL CHEMISTRY.

A. H. GILL, REVIEWER.

Alabama Coal in By-product Ovens. BY W. B. PHILLIPS. *Am. Manuf.*, 17, 446.—The paper gives the results of coking washed coal from the Pratt seam in Otto–Hoffman ovens at Jefferson Co., Alabama. Four different runs of about 7 tons each were made. The results are as follows:

	Analysis.	
	Coal.	Coke.
Moisture	5.95	dry
Volatile matter	32.69	0.98
Fixed carbon	54.33	90.22
Ash	7.03	8.80
Sulphur	0.94	1.28

Yield of gas 9600 cu. ft. per ton; heating power 630 B.T.U. per cu. ft.; candle power 11.4; coke 70.6 per cent.; tar 90 lbs. per ton; sulphate of ammonia 23.6 lbs. per ton; about 3000 cu. ft. of gas per ton are available.

The Explosive Properties of Acetylene. BY F. C. PHILLIPS. *Proc. Eng. Soc. Western Pa.*, 13, 299.

G. W. ROLFE, REVIEWER.

Additional Notes on the Sugar-cane Amid. BY EDMUND C. SHOREY. *J. Am. Chem. Soc.*, 20, 133, 137.—The author gives further experimental evidence that the amid described in a previous paper (*this Rev.*, 4, 34) is glycocoll containing a trace of leucine.

Making Concrete in Multiple Effects. BY L. M. SONIAT. *La. Planter and Sugar Mfr.*, 20, 248.—This is an account of experiments with the Lillie triple-effect in boiling clarified juice directly to concrete. In order to give the requisite hardening temperature the juice was run "backwards;" *i. e.*, from the highest to the lowest vacuum-cell. The author believes that this process will prove a distinct economy over working centrifugal sugars especially where transportation rates are high. The steam saving is also thought to be considerable. An analysis of the concrete is given.

The Manufacture of Concrete in the Multiple Effect. By S. M. Lillie. *La. Planter and Sugar Mfr.*, 20, 248–251.—This paper offers a further treatment of the subject on similar lines. A short history of the manufacture of concrete, and statistics as to the profits in this work as carried on twenty years ago are given, as well as analyses. The vital point of the probable influence of this industry on the sugar market is also discussed.

The Cambray Process of Double Sulphuring. By G. Cambray. *La. Planter and Sugar Mfr.*, 20, 203.—A series of analyses are given of mill juices and clarified syrups of El Puente Sugar House, showing an average increase of quotient of purity from 82.87 to 91.20 by this method of clarification.

Sugar Beet Investigations in Wisconsin during 1897. *Bull. Agr. Sta. Univ. of Wis.*, 64, 3–104. **Sugar Beets in South Dakota.** *Bull. U. S. Expt. Sta., So. Dakota*, 56, 3–32. **Sugar Beet Investigations.** *Bull. Cornell Univ. Agr. Expt. Sta.*, 143, 493–574. **The Sugar Beet in Illinois.** *Univ. of Ill. Agr. Expt. Sta.*, 49, 1–52. **The Composition and Production of Sugar-Beets.** By L. L. Van Slyke, W. H. Jordan and G. W. Churchill. *Bull. N. Y. Agr. Expt. Sta.*, 135, 543–572.—These bulletins give evidence of the continually growing interest in this subject. In the main they deal with experiments in cultivation. Besides giving the results of analytical examinations of experimental crops, they are excellent manuals of beet culture.

F. H. THORP, REVIEWER.

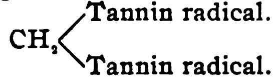
Paints, Painting Materials and Miscellaneous Analyses. By H. H. Harrington and P. S. Tilson. *Bull. No. 44, Texas Agr. Expt. Sta., 1898.*—The chief matter of interest in this bulletin is an investigation of the value of cottonseed oil to be used for paint as a cheap preservative for outside work. Tests of the drying properties of the oil were made with a view to its use instead of linseed oil. Two methods of testing were used: (A) Boiling the oil with different drying agents in order to increase its drying properties. (B) Treating the oil with gasoline or turpentine. Seventeen experiments were made under (A) using borate of manganese, chloride of lime, black oxide of manganese (MnO_2?), nitrous acid, caustic soda, lead acetate and various mixtures of these substances. The time and temperature of the heating were varied. The prepared oils were mixed and ground with a good quality of "white lead," and the paint thus made applied to pine boards and dried in the sun. The best result was obtained with an oil which had been heated to 170° C. for one hour, with 0.3 per cent. of manganese borate. This paint dried in six and a half hours. The next best paint was made with an oil which was heated forty-five minutes to 70° C. with 1 per cent. of sodium hydroxide and then treated with 2.5 per cent. of lead oxide, and heated several (?) hours from 130° to 170° C. This sample, as well as several others, also dried in six and a half hours. But in all cases, the films obtained were less hard and firm than those yielded by linseed oil. Many of the samples required two, six, and even eight days for drying, while others were entirely useless. The oils tested with turpentine and gasoline were less satisfactory. One sample, mixed with 10 parts turpentine, dried in eight and a half hours, giving a fair paint. As a rule, cottonseed oil affords less gloss and hardness in the film, but somewhat more tenacity than linseed oil. The conclusion reached is that a properly made cottonseed oil may well replace linseed paints for cheap outdoor work. It is also suggested that the boiling of the oil might be done by "anyone;" but in the opinion of the reviewer, this statement might well have been omitted, since if left to the care of an inexperienced person, the kettle is almost certain to boil over. The authors also devote some space to discussion of the tabulated analyses of thirteen commercial paints. One "pure white lead" consisted of 66.79 per cent. barytes ($BaSO_4$), 15.59 per cent. zinc oxide and 9.81 per cent. "white lead." Another contained 74.5 per cent. barytes. They also find that red and yellow ochres are most suitable for general use with crude cottonseed oil, but with well prepared "boiled" oil, it may pay to use the best white lead or white zinc. The remainder of the bulletin is devoted to tabulated analyses of mineral waters (36 samples) cottonseed meal, coals, clays, fertilizers, asphalts, ashes, ores, and a lignite tar distillate.

Estimation of Mineral Matter in Rubber Goods. BY L. DE KONINGH. *J. Am. Chem. Soc.*, 19, 952.—This is a method designed to remove all the soluble mineral matter by treating the rubber with fuming hydrochloric acid. The rubber plus the insoluble matter is weighed, and the ash determined by ignition as usual. The acid filtrate may then be analyzed separately.

The Semet-Solvay Coke Oven and its Products. BY WILLIAM H. BLAUVELT. *Proc. of the Ala. Industrial and Scien-*

tific Soc., 7, 33.—This is a general description of the Semet-Solvay oven as erected at Ensley, Ala., and a discussion of the properties of the coke, gas, ammonia and tar obtained from it. The usual charge is 4½ tons, and the time of coking is about 24 hours; the time of discharging and charging is about 15 minutes. The amount of gas varies from eight to ten thousand cubic feet per ton of 2000 pounds. The heat utilization is very perfect. The gases from the retort are cooled and passed through scrubbers and condensers to remove ammonia and tar; a part of the gas is then burned with air to heat the retorts and the boilers, supplying steam for operating the plant; the remainder is available for lighting, or other heating purposes. In the retort oven the coking takes place without access of air, and a certain amount of the hydrocarbons distil off, are broken down, and some graphitic carbon is deposited on the coke. This increases the yield of coke over that obtained from the bee-hive oven, into which some air enters, so that the hydrocarbons are largely burned in the oven itself, together with a portion of the coke. In a bee-hive oven with Connellsville coal, yields of 65 per cent. coke are considered good; but from the retort oven 75 per cent. coke is obtained. In the bee-hive the coal lies in a layer about 24 inches deep, over a broad surface; the bottom of the oven being cold, from the quenching of the previous charge and contact with new coal, the coking begins at the top and extends downward, the coke swells and develops the characteristic cellular structure. This texture is thus entirely beyond control and dependent upon the character of the coal; hence many coals do not yield a good coke in the bee-hive oven. In the retort oven, the charge lies in a tall narrow mass, about 5 feet high by 20 inches wide, while the retort, having been quickly emptied by mechanical means and recharged while very hot, the coking and distillation begins at once and the gases formed at each side, penetrate to the center of the mass, where they meet and rise to the top; thus a cleavage plane is formed midway between the walls. The coke in contact with the hot wall is denser, and that in the center more spongy than the main mass. The cellular structure is more compressed, since the narrow retort allows no expansion in the direction of the flow of the gases and because of the depth of the charge. The cellular structure depends somewhat upon the size of the oven, the temperature, and the time of coking. Owing to the rapid heating of the charge, coals may be coked in these ovens which cannot be used in the bee-hive form, since the bituminous matters are decomposed before they can escape. Tests have been made with retort and with bee-hive cokes, both produced from Connelsville coal, during a year's running of a blast-furnace, the fuel charge being changed at times from all retort coke to all bee-hive coke, or to a mixture of both, and yet no indications of difference in the fuel was observed in the working of the furnace. It is not claimed that the retort product is superior to the Connelsville bee-hive coke, but that certain other coals, which are unfit for bee-hive coking, will yield a fair product when coked in retorts; even from impure coal a coke good enough for brewers, malsters or domestic uses, may be made. The retort coke is harder and is thought to withstand the exposure to the furnace gases in the upper part of the furnace better than bee-hive coke; but it has not the silvery luster or glaze of the latter, and is sometimes too wet, owing to improper quenching after drawing. The effect of moisture in the coke is not decided, but tests have been made indicating that it protects the coke from the furnace gases by its cooling action, and by thus allowing more fuel to reach the zone of fusion, should decrease the fuel consumption. It is shown that chemical analysis is of little value in indicating the coking power of coal. But a method devised by Louis Campredon and used in the Vignac Works, in France, is explained. Weighed portions of the finely powdered coal are mixed with varying quantities of sand and the mixtures heated to red heat in closed crucibles until the coal is carbonized. When cold, a powdery or more or less coked mass is left; from the test portion showing the maximum quantity of sand that the coal can bind together, the coking qualities are estimated; the weight of the coal being unity, the binding power is shown by the weight of agglomerated sand. The most binding coal tried was found equal to 17, while pitch showed a power of 20.—The ammonia is given off most rapidly about ten hours after charging but ceases entirely before the coking is complete, leaving in the coke about one-quarter of the nitrogen originally in the coal. The yield of ammonia is calculated as sulphate and from Pittsburg coal averages about 16 to 22 pounds per ton of coal. The tar is of good quality and owing to the increased manufacture of water gas, it now finds a ready market. The yield of tar from Pittsburg coal varies from 70 to 80 pounds per ton. The by-product oven gas will probably have to be used as fuel, since it contains less illuminants than that from gas-house retorts; but from good gas coal it would furnish a fairly good illuminant.

Formaldehyde Tannin. *U. S. Pat. No. 598,914. Abstract in Leather Manufacturer*, 9, 39.—This is a new substance patented by H. C. Durkopf, and called methylene digallotannic acid. It is made by the condensation of tannin with formaldehyde in the presence of hydrochloric acid. The formula assigned to it is



$CH_2{<}\begin{array}{l}\text{Tannin radical.}\\ \text{Tannin radical.}\end{array}$

BIOLOGICAL CHEMISTRY.

W. R. WHITNEY, REVIEWER.

An Exudation from Larix Occidentalis. BY HENRY TRIMBLE. *Am. J. Pharm.*, 70, 152–153.—This is not a resinous exudation but of a saccharine nature, and is said to be used as a food by Indians. It was found to contain 19.38 per cent. reducing sugar, 68.69 per cent. non-reducing sugar, 5.02 per cent. moisture, 0.41 per cent. ash, and 6.47 per cent. fibre.

Diastatic Fungi and Their Utilization. BY JOKICHI TAKAMINE. *Am. J. Pharm.*, 70, 137–141.—The author describes the manufacture of taka-moyashi, taka-koji, and taka-diastase. A fungus, the Japanese moyashi, is employed. This is cultivated in a starchy material as ground corn, which has been steamed to gelatinize the starch. The spores resulting from the growth of the fungus are separated by sifting. This product is known as taka-moyashi. Taka-koji results from mixing the spores with steamed wheat bran and allowing the culture to grow until a maximum diastatic value is reached. Taka-diastase is precipitated from the aqueous extraction of taka-koji by addition of alcohol.

Preliminary Observations on a Case of Physiological Albuminuria. BY TORALD SOLLMANN AND E. C. MCCOMB. *J. Expt. Medicine*, 3, 138–145.—This is the study of a case of occurrence of coagulable proteids in human urine which lasted for a considerable period and was unaccompanied by symptoms of disease. During four months of investigation the quantity of proteid present varied but little from day to day. The average daily quantity was 0.5317 gram. It was found to vary directly as the urea and inversely as external temperature. The influence of sleep, of dietary changes, of diuretics, and of drugs acting on the circulation, were also observed.

On the Occurrence of Methyl Salicylate. BY EDWARD KREMERS AND MARTHA M. JAMES. *Pharm. Rev.*, 16, 100–108. —This contains a collection of abstracts of the literature on the occurrence of this ester in plants.

The Present Condition of Formaldehyde as a Disinfectant. BY C. O. PROBST. *Ohio Sanitary Bull.*, 2, 36–42.—While the author's paper is only a summary of recent work on the subject, the discussion which follows it shows how generally this disinfectant is being used and also that its superiority over burning sulphur is held in doubt. The author evidently believes that failures in the case of the formalin may be attributed to causes which will soon be removed by a clearer understanding of the conditions necessary and quantities of the gas requisite for proper fumigation.

Alkaloidal Constituents of Cascarilla Bark. By W. A. H. Naylor. *Am. J. Pharm.*, 70, 237–239.—The author believes that from this bark he has extracted two alkaloids, betaïne and cascarilline.

E. H. Richards, Reviewer.

Dietary Studies in New York City. By W. O. Atwater and Charles D. Woods. *Expt. Sta. Bull. U. S. Dept. Agr.*, 46, 1–117.—In many respects this is the most satisfactory of the dietary studies thus far published by the U. S. Dept. of Agriculture, partly because a summary only of the results is given in the text and the details reserved for the appendix, and partly because of the variety of occupation and condition of the 23 families. These studies were made among the so-called poor in the worst congested districts of New York, and yet 11 of the 23 families paid daily 20 cents and over per person for food, and 2 of them over 40 cents, while only 3 spent as little as 16 cents. The calculation of the cost of each 1,000 calories in the different dietaries brings out more clearly the lack of economy in buying. A well-selected dietary may be made up so as to cost from 5 to 5.5 cents per 1,000 calories; only 4 of the list given come within this limit, while 8 cost over 7 cents per 1,000 calories, and one of these high cost dietaries furnished the lowest total food value found.

A Digest of Metabolism Experiments. By W. O. Atwater and C. F. Langworthy. *Expt. Sta. Bull. U. S. Dept. Agr.*, 45, 1–434.—The Department of Agriculture has done great service to all students of problems relating to food and nutrition, in bringing together a summary of the results hitherto obtained, however contradictory they may be.

G. W. Rolfe, Reviewer.

Observations on Some of the Chemical Substances in the Trunks of Trees. By F. H. Storer. *Bull. Bussey Inst., Harvard Univ.*, 35, 386–408.—This is an able and suggestive paper on the nature and origin of the carbohydrates stored in the wood of trees. It also discusses analytical methods for the differentiation of starches and of pentosans and their limitations, the distribution of starch and pentosans in the tree, and their comparative food values interpreted by the habits of rodents and certain economic uses. Many analytical data are given and many authorities cited.

SANITARY CHEMISTRY.

E. H. RICHARDS, REVIEWER.

Recent Work in England on the Purification of Sewage. BY LEONARD P. KINNICUTT. *J. Am. Chem. Soc.*, 20, 185–194.—The author writes from personal observation of the favorable results of experiments made in the more efficient utilization of those bacterial agencies which, in absence of air, accomplish the quick solution of a large part of the organic substances met with in ordinary town sewage.

Municipal and Other Water Supplies. *North Carolina Board of Health Sixth Biennial Rep.*, *1897*, 56–96.—Analyses of twenty samples of water from various towns in North Carolina are given, with reports and correspondence in regard to bacteriological examinations. The whole statement is instructive as to the status of sanitary knowledge and control in many of the states.

The Interpretation of Sanitary Water Analysis. BY FLOYD DAVIS. *Eng. Mag.*, *1898*, 68.

Engineering Chemistry of Boiler Water. BY H. HEFFEMANN. *Railway and Eng. Rev.*, *1898*, 203.

The Purification of River Water Supplies. BY A. HAZEN. *Eng. Mag.*, *May*, *1898*.

AGRICULTURAL CHEMISTRY.

W. R. WHITNEY, REVIEWER.

The Relative Sensibility of Plants to Acidity in Soils. BY WALTER MAXWELL. *J. Am. Chem. Soc.*, 20, 102–107.—Of a number of vegetables, cereals, etc., the greater part were found to be exceedingly sensitive to the presence of acid. Millet and maize were least affected by acid.

Milk Fat from Fat-free Food. BY F. H. HALL. *N. Y. Agr. Expt. Sta. Bull.*, *Popular Edition*, 132.—An experiment is described in which materials which were practically fat-free, were fed to a cow during a period of three months. The fat which the cow produced in the milk during this time was not derived, the author believes, either from fat in the food, from stored fat of the animal's body, or from proteids in its food, nor was it formed at the expense of two or more of these. A part at least must have come from carbohydrates of the food. That fat may be formed from carbohydrates has been pretty generally recognized and was discussed in the *U. S. Expt. Sta. Rec.*, 7, 538, and 8, 179. That protein does not produce fat is also there stated as the result of Pfluger's work.

Cotton Culture. Fertilizer Formulas. By. R. J. Redding. *Georgia Expt. Sta. Bull.*, 39, and **Experiments with Cotton.** By J. F. Duggar. *Ala. Agr. Expt. Sta. Bull.*, 89 and 91.—These contain accounts of experiments with different varieties of cotton plants under the influence of different fertilizing mixtures.

Analyses of Commercial Fertilizers. *Kentucky Agr. Expt. Sta. Bull.*, 71.

The Chemical Composition of Utah Soils, Cache and Sanpete Counties. *Utah. Agr. Coll. Bull.*, 52.

Cooperative Experiments made by the Ohio Students' Union. *Ohio Agr. Expt. Sta. Bull.*, 88.

Cooperative Fertilizer Experiments with Cotton in 1897. *Ala. Agr. Expt. Sta. Bull.*, 91.

Experiments with Corn. *Ala. Agr. Expt. Sta. Bull.*, 88.

Experiments with Cotton. *Ala. Agr. Expt. Sta. Bull.*, 89.

Concentrated Feed-Stuffs. *Hatch Expt. Sta. of Mass. Agr. Coll. Bull.*, 53.

Calories of Combustion in Oxygen of Cereals and Cereal Products, Calculated from Analytical Data. By H. W. Wiley and W. D. Bigelow. *J. Am. Chem. Soc.*, 20, 304–316.

F. H. THORP, REVIEWER.

Corrosive Sublimate and Flour of Sulphur for Potato Scab. Experiments made in 1896. By H. Garman. **The Use of Corrosive Sublimate for Potato Scab in 1897.** By H. Garman. *Ky. Agr. Expt. Sta. Bull. No.* 72, Feb., 1898.—The first of the above investigations was made to determine whether the scab fungus was introduced into the soil on the seed potatoes. Before planting, the potatoes were rolled in flowers of sulphur or soaked for an hour in a solution of mercuric chloride (4½ ounces in 30 gallons of water). The test showed that sulphur had little effect in preventing scab but that mercuric chloride did check the disease very greatly. The second investigation was to determine the strength of the mercuric chloride solution that could be safely used in treating the seed potatoes. The results showed that treatment of the seed reduced the proportion of scabby potatoes; that the percentage of scab diminishes with the increase of the strength of the solution used; that short soaking of the seed in strong solution was as effective as long exposure to weaker solutions; and that very strong solutions caused some reduction in the yield, if the soaking was prolonged. Treatment for one hour with 4½ ounces of corrosive sublimate per gallon of water was found most suitable. Stronger solutions may be used for short soaking.

ASSAYING.

H. O. HOFMAN, REVIEWER.

A Cement for the Assay Office. BY R. MARSH. *Eng. Min. J.*, 65, 37.—The author recommends for repairs of cracks in muffles from 1 to 2 parts litharge and 10 parts bone ash mixed dry and then moistened with water to the consistency of paste. This cement will stand fire, be tight, hard and strong, and will not crack.

The Assay of Copper Bullion. BY A CORRESPONDENT. *Eng. Min. J.*, 65, 223.—The method recommended is as follows: Weigh 1 assay ton into a No. 5 beaker, add 120 cc. cold water, then 100 cc. nitric acid, boil when violent action ceases until red fumes disappear, dilute to 300 cc., filter through 11 cm. paper, sprinkle 2½ grams test-lead over it and, having gathered together the edges, press into a 2½ inch scorifier charged with 5 grams test-lead so as to flatten out the point of the filter. Add to the hot filtrate a slight excess of brine, stir vigorously (by hand, by compressed air, or other mechanical device), when silver chloride will settle out in about 30 minutes with 20 oz. copper. Filter through a double filter, sprinkle with test-lead as before, and transfer to scorifier containing gold filter, place in front of muffle, dry paper and burn. Then place scorifier in the opening of muffle to finish incineration, cover sintered mass with 15 grams test-lead and ½ gram borax glass and scorify. This gives a button weighing about 4 grams, which is cupelled in a small cupel and parted.

The Assaying of Gold Bullion. BY C. WHITEHEAD AND T. ULKE. *Eng. Min. J.*, 65, 189.—This paper is a short description of the method employed at the mint. This is discussed under the heads, melting and sampling, gold assay, determination of base metals, determination of silver.

The Assaying of Silver Bullion. BY C. WHITEHEAD AND T. ULKE. *Eng. Min. J.*, 65, 250–251.—This paper discusses the assay of silver bullion at the mint in the same manner as a previous one did the gold assay. It covers grading and sampling of bullion, standardizing of the sodium chloride solution, determination of the silver, influence of alloyed metals and organic matter, and accuracy and rapidity of the assay.

METALLURGICAL CHEMISTRY.

H. O. HOFMAN, REVIEWER.

The Influence of Altitude on Smelting. BY H. LANG. *Eng. Min. J.*, 65, 131–132.—The author attributes the greater consumption of fuel at a high altitude than at a low one to the fact that as the intensity of combustion depends upon the atmospheric pressure, at a high altitude the gases leave a furnace in a more attenuated condition than at a low one and consequently absorb and carry away a greater amount of heat which has to be made up by a greater amount of fuel. Referring to the above paper, J. T. Smith (*Ibid.* p. 277) states that by arching over the top of the cupola in an iron foundry and having the side-exits closed by flap-doors, a greater pressure was maintained than that of the air outside and a considerable saving of fuel effected, the percentage of fuel being 7 on the pig charged. With a cupola 36″ in diameter, narrowing down to 22″ at the crucible, 18000 lbs. were melted down in one hour and thirty-five minutes from the time the blast was started.

Recent Smelting Practice in Colorado. BY L. S. AUSTIN. *Eng. Min. J.*, 65, 282–283.—The practice of lead and copper smelting in Colorado and other parts of the country has undergone important change which is briefly reviewed in this paper. The subjects discussed are: Sampling ores and base bullion, size of furnaces and management, recovery of flue-dust, automatic charging, roasting of ores, the separation and disposal of slag, handling of materials, reverberatory smelting, blast-furnace fuel and changes in character of ore smelted. The conclusion that the writer arrives at is that the changes have been mainly in the mechanical details for the saving in labor and the better separation of waste from main and intermediary products.

The Garretson Copper Smelting Furnace. BY O. S. GARRETSON. *Eng. Min. J.*, 65, 160–161.—The aim with this blast-furnace is to carry on in one continuous operation the three necessary processes for treating a sulphide copper ore, *viz.*, roasting, smelting, and converting. While it has the high endorsement of Dr. E. D. Peters, Jr., the reviewer cannot but believe that this furnace will fail to do satisfactory work more often than it will prove a success, because the three processes require for the best work conditions differing too much to be obtainable in a single furnace. Should this great difficulty be temporarily overcome, it is almost inevitable that the slightest changes will prove detrimental to one or the other process.

A Copper-Arsenic Compound. BY H. C. HAHN. *Eng. Min. J.*, 65, 401.—The author found in a salamander of a lead blast-furnace dark green hexagonal crystals which upon analysis showed the following composition in percentages: Cu. 61.03, Fe. 0.97, Pb. 0.44, As. 35.50, Sb. 1.08, S. 0.89, Total 99.91, corresponding to the formula Cu_2As. The sp. gr. at 10° C. was 7.976, at 20° C. 8.008, at 30° C. 7.578.

The Electrolytic Production of Zinc. BY EDITOR. *Eng. Min. J.*, 65, 336.—The paper briefly reviews the leading processes for the electrolytic reduction of zinc; *viz.*, the processes of Ashcroft, Siemens-Halske, Dieffenbach and Hoephner, and concludes that at present zinc can be electrolytically produced with profit only when the zinc is removed from ores containing more valuable metals so as to permit them to be satisfactorily treated.

Notes on Aluminum. BY J. M. SMITH. *Assoc. Eng. Soc.*, 20, 1–19; *Discussion*, 19–23.—The paper offers little that is new, being a brief review of the properties of aluminum and its alloys, of the ores, of the manner of preparing the alloys and of the Hall, the Héroult and Minet processes for producing the metal. The discussion brings out the proposed use of aluminum wire as electric conductor and the use of the metal in the manufacture of semi-steel.

The Dry Separation of Gold and Copper. BY F. R. CARPENTER. *Eng. Min. J.*, 65, 193.—After a general discussion of methods of separating gold and copper, the writer outlines his recently patented process (No. 897,139, January 11, 1898), which consists in exposing metallic copper containing silver and gold to an oxidizing fusion when cuprous oxide and, in the presence of silica, cuprous silicate will form. Both are readily fusible and take up little silver and hardly any gold. By drawing off the oxidized copper from the surface of the metal bath, as with litharge in cupelling, a satisfactory separation of copper from precious metal can be effected. An addition of lead toward the end of the process protects the silver so that a larger percentage remains with the gold than would be otherwise the case. The oxide or silicate of copper is sold to copper works or used again for collecting precious metal in smelting pyritic ores free from or low in copper.

Temperature in Amalgamation. BY F. R. CARPENTER. *Eng. Min. J.*, 65, 126–127.—At the Homestake gold mines, Lead City, S. D., two amalgamating batteries were run by T. J. Grier upon the same ore, in one the battery water had a temperature of 50° F., in the other, of 60° F. and over. The yield in gold with the former was found to be decidedly greater than with the latter. The explanation of this appears to be that warm water, making the low-grade amalgam from the fine gold fluid, causes it to run off more readily from the plates than cold water which leaves the amalgam more pasty and hard and more firmly adhering to the plate.

Experiments on Roasting Telluride Ores. By E. D. Skewes. *Eng. Min. J.*, 65, 488.—This paper is a record of experiments made in Western Australia. In dry-crushing a silver-bearing telluride gold ore with 3.66 per cent. sulphur and 0.33 per cent. copper and then roasting, the sulphur being eliminated to 1 per cent., it was found that the loss in precious metal was very much lower than when it had been wet-crushed. The cause of this was discovered to be in the water used which contained 8.5 per cent. solid matter; *viz.*, $MgCl_2$ and NaCl, 6.95, CaO, 0.86, Al_2O_3 and Fe_2O_3 0.49, S 0.12. The chlorides of the water remained with the ore, being decomposed in the roast and volatilizing the precious metals.

Ore Treatment in Boulder County, Colo. By C. C. Burger. *Eng. Min. J.*, 65, 129–130.—The gold ores of Boulder County are sulphides and tellurides, the former are treated by the Colorado system of battery amalgamation, the latter by leaching with potassium cyanide and chlorine water. The paper describes the technical details of the barrel-chlorinating plant of the Delano Mining and Milling Co., some of the novel points of which may be recorded. As to general arrangement, the crushing, roasting, and chlorinating houses are on level ground instead of on a hill-side, as is, or rather was, usual, the ore being handled by belt elevators and belt and screw conveyors. The ore is roasted at a high temperature in a Pearce turret furnace which has water-cooled rabble-arms and plow-shaped rabbles of forged steel. The loss of gold by volatilization is very slight. The roasted ore is automatically cooled and delivered into the hoppers of the chlorinating barrels. The raw ore contains 2.5 per cent. sulphur; in the roasted ore the sulphur must be reduced a few hundredths of one per cent. if an extraction of 95 per cent. of the gold is to be attained. The barrels used hold 5-ton charges. They have the Rothwell quartz filter, the quartz having been crushed to pass a 2-mesh sieve. This allows the slimes to pass through the filter, and these have to be settled in clarifying vats before the gold can be precipitated. For solution there is required per ton of ore 10 lbs. bleaching powder, 15 lbs. sulphuric acid of 66° B., and for precipitation $\frac{1}{8}$ lb. sulphur, $\frac{5}{8}$ lb. iron sulphide, and $1\frac{1}{4}$ lbs. sulphuric acid.

Chlorinating and Cyaniding. By C. C. Burger. *Eng. Min. J.*, 65, 427.—A continued discussion (*this Rev.*, 4, 36).

Absorption of Gold by Wooden Leaching Vats. By F. L. Bosqui. *Eng. Min. J.*, 65, 248.—Many losses of gold in lixiviation plants are attributed, for want of a better explanation, to absorption by the wooden leaching vats. An investigation of the subject gave the author results which prove that the amount of gold taken up by the vats is relatively small. California redwood absorbed 22 per cent. of its weight of solution. Assuming it to be 50 per cent., a vat weighing 6 tons would absorb 3 tons of solution worth about $5.00 in gold per ton. With plants treating from 3000 to 4000 tons tailings per month, the loss would not be very much noticed. But the absorption might be cumulative, the leaching vats being part of the time exposed to air, when absorbed solution being partly evaporated, gold might be deposited. The author made a series of experiments with different kinds of woods and with intermittent and continuous contact of wood and solution. He found the amounts of gold absorbed to be exceedingly small by either method of contact.

Influence of the Anodes in Depositing Gold from Its Cyanide Solutions. By E. Andreoli. *Eng. Min. J.*, 65, 100–101.—In the Siemens and Halske process, carried out successfully in the Transvaal, gold is recovered from dilute cyanide solutions which would be lost if it were precipitated by zinc shavings. Iron anodes and sheet lead cathodes are used. The iron anode is attacked, forming Prussian blue, which contaminates the electrolyte and hinders a perfect precipitation of the gold, only from 60 to 70 per cent. being recovered. The lead has to be replaced when the gold is separated by cupellation. The author found that an anode of peroxidized lead was absolutely insoluble and lasted any length of time; he recommends the use of iron cathodes from which the deposited gold is to be separated by immersion in melted lead.

Notes on the Moebius Process for Parting Gold and Silver as Carried on at the Guggenheim Smelting Works, Perth Amboy, N. J. By P. Butler. *Can. Min. Rev.*, 17, 81–88.—The paper describes in a brief elementary way the three departments of the works: electrolytic copper refining by the multiple process, desilverizing of base bullion by the Parkes process, and electrolytic parting by the Moebius process. The many carefully made, but badly printed drawings accompanying the paper, lose some of their value by not being either dimensioned or having the scale given to which they were made.

Molding Sand. By D. H. Truesdale. *J. Am. Foundrymen's Assoc.*, 3, 159–176.—The paper treats in detail of the four leading properties of molding sand; *viz.*, refractoriness, porosity, fineness, and bond.

Comparative Fusibility of Foundry Irons. BY TH. D. WEST. *J. Am. Foundrymen's Assoc.*, 3, 127–158.—The author shows that chilled iron will melt faster than gray iron of the same composition and advocates the use of sandless pig for foundry purposes. He further discusses the changes in composition due to re-melting, the production of semi-steel castings, and the shrinkage and contraction of cast iron.

Effects of Phosphorus on the Strength and Fusibility of Iron. BY TH. D. WEST. *J. Am. Foundrymen's Assoc.*, 4, 123–128.—The author carried on a series of experiments to show the strength and fluidity of foundry iron was increased by the addition of phosphorus.

Carbon and Strength of Iron. BY G. R. JOHNSON. *Iron Trade Rev.*, 21, 8. The author contends that in the analyses according to which pig iron is sold, both carbons should be included, not alone silicon, sulphur, phosphorus, and occasionally manganese, as the strength of the pig increases with a diminishing percentage of carbon.

Value of Metalloids in Cast Iron. BY M. MCDOWELL. *J. Am. Foundrymen's Assoc.*, 4, 97–114. The author gives the subjoined table:

No.	Kind.	Price per ton.	Total C.	Si.	P.	S.	Mn.
1	Foundry	$12.00	3.68	2.90	0.75	0.01	0.30
2	Foundry	11.50	3.30	2.25	0.70	0.02	0.40
3	Foundry	11.00	3.25	1.50	0.30	0.03	0.50
4	Gray forge	10.50	3.80	1.00	0.65	0.04	0.62
5	Mottled forge	10.00	3.75	0.70	0.50	0.05	0.05(?)
6	White forge	9.50	3.65	0.40	0.35	0.10	0.96

to show how the value of pig iron increases with the silicon it contains and what harm is done by the sulphur, each unit of which is said to neutralize 10 units of silicon. The table also demonstrates the necessity of the presence of manganese and the value of phosphorus. In a second table, representing six different heats, the author brings out the changes foundry iron may undergo in composition and physical properties.

Oxidation of Foundry Metals. BY T. D. WEST. *J. Am. Foundrymen's Assoc.*, 4, 115–123. The paper is an experimental study into the loss of metal incurred in foundries from oxidation which is claimed to be greater when pig iron is cast in chills instead of in sand.

Annealing of Malleable Cast Iron. BY G. C. DAVIS. *J. Am. Foundrymen's Assoc.*, 4, 86–91.—This paper is mainly a review of one read by G. P. Roylston before the English Iron and Steel Institute. The author, however, brings out some of the differences between English and American practice. For instance, in England the pig iron used contains 0.112 per cent. manganese giving a casting with 0.043 per cent. manganese ; in this country the mixture contains 0.40–0.80 per cent. and the casting 0.20–0.40 per cent. manganese. The silicon in the product from a Western foundry ranged from 0.75 to 0.98 per cent. Sulphur must be low, under 0.11 per cent., as, if present in larger amounts, it interferes with annealing. Thus, a ⅝-inch casting with 0.133 per cent. S. showed after the first annealing G. C. 0.547, C. C. 0.515 ; after the second annealing G. C. 0.505, C. C. 0.380. Roll-scale is generally used here instead of iron ore as in England, the scale being reoxidized at intervals by spreading on the floor and sprinkling with ammonium chloride. The annealing pots are cast from cupola metal and last for five or six heats.

What is Semi-steel? By A. E. Outerbridge. *Digest of Phys. Test*, 3, 99–103.—The object of this paper is to show that calling the product obtained by charging a cupola with pig iron and steel and wrought iron scrap by the new name, semi-steel, is not justified, as chemically it shows no resemblance to steel or malleable iron, and physical tests show an equally great divergence ; in fact, the so-called semi-steel is simply a strong, close-grained cast iron.

APPARATUS.

A. H. Gill, Reviewer.

A Constant Temperature Device. By H. P. Cady. *J. Phys. Chem.*, **2**, 242.—It comprises an apparatus in which a circulation of water at a constant temperature is attained by means of a siphon emptying into a rotating funnel. The rotation causes the water in the center of the funnel to become depressed which sets the siphon in action.

A New Form of Hydrogen Generator. By E. W. Magruder. *Am. Chem. J.*, 19, 810.—The apparatus is designed to take the place of the Bunsen electrolytic generator, and obviates the difficulties of that form by having the electrodes in separate tubes. The apparatus is said to yield pure hydrogen and may be obtained of Greiner, of New York.

A New Form of Discharger for Spark Spectra of Solutions. By L. M. Dennis. *J. Am. Chem. Soc.*, **20**, 1.

A New Electrolytic Stand. By G. T. Hough. *J. Am. Chem. Soc.*, **20**, 268.

A Modified Air-bath. By F. P. Venable. *J. Am. Chem. Soc.*, **20**, 271.

A Collector for Distillation of Ammonia from Water. By F. P. Dunnington. *J. Am. Chem. Soc.*, **20**, 286.

A Device to Prevent Loss by Spattering. By A. H. Low. *J. Am. Chem. Soc.*, **20**, 233.

[CONTRIBUTION FROM THE MASSACHUSETTS INSTITUTE OF TECHNOLOGY.]

REVIEW OF AMERICAN CHEMICAL RESEARCH.

VOL. IV. NO. 7.

ARTHUR A. NOYES, Editor; HENRY P. TALBOT, Associate Editor.
REVIEWERS: Analytical Chemistry, H. P. Talbot and W. H. Walker; Biological Chemistry, W. R. Whitney; Carbohydrates, G. W. Rolfe; General Chemistry, A. A. Noyes; Geological and Mineralogical Chemistry, W. O. Crosby; Inorganic Chemistry, Henry Fay; Metallurgical Chemistry and Assaying, H. O. Hofman; Organic Chemistry, J. F. Norris; Physical Chemistry, H. M. Goodwin; Sanitary Chemistry, E. H. Richards; Technical Chemistry, A. H. Gill and F. H. Thorp.

INORGANIC CHEMISTRY.

HENRY FAY, REVIEWER.

On the Action of Hydrogen Sulphide upon Vanadates. BY JAMES LOCKE. *Am. Chem. J.*, 20, 373–376.—Hydrogen sulphide reacts with sodium vanadate in the cold, but owing to the formation of sulphovanadate on the surface the reaction is not complete unless the liquid is heated to 500°–700°. At this temperature the author finds that the absorption of hydrogen sulphide is almost violent. The increase of weight in the sodium vanadate corresponds to that required by the reaction:

$$Na_3VO_4 + 3H_2S = Na_3VOS_3 + 3H_2O.$$

The sulphovanadate formed in this way corresponds to the salt described by Krüss, which was made in the wet way. Sodium pyrovanadate reacts with hydrogen sulphide with the formation of the sulphovanadate, $Na_4V_2O_3S_4$, which resembles potassium permanganate in appearance. The salt is exceedingly hygroscopic, dissolves in water to a deep reddish purple solution, which gradually loses hydrogen sulphide, changing to the colorless sodium pyrovanadate. This change of color is also characteristic of the free sulphovanadic acids, but it was found impossible to isolate a pure compound. The vanadates of the heavy metals are not so readily changed to the sulphovanadates. Lead pyrovanadate, however, passes over to the sulphovanadate, $Pb_2V_2O_3S_4$, on heating in a current of hydrogen sulphide at a full red heat.

Some New Lime Salts. BY H. C. HAHN. *Eng. Min. J.*, 65, 404.—By evaporating slowly a solution of calcium hydroxide which had been saturated with hydrogen sulphide crystals of the composition $CaS.3H_2O$ were obtained; by heating, filtering, and again saturating with hydrogen sulphide and evaporating, crystals having the composition $CaS.H_2O$ were deposited.

The Solubility of Silver Chloride. By H. C. Hahn. *Eng. Min. J.*, 65, 434.—A solution containing 475.3 grams of $CaCl_2$ in one liter dissolves 2.835 grams silver chloride at 0°, and 8.147 grams at 100°. It is stated that the solubility is greater in saturated solutions of magnesium chloride.

Upon the Salts of Hydronitric Acid. By L. M. Dennis and C. H. Benedict. **Crystallographic Notes.** By A. C. Gill. *J. Am. Chem. Soc.*, 20, 225–232.—The lithium, sodium, potassium, cesium, and rubidium salts were prepared by neutralizing the corresponding hydroxides with the free acid, and the calcium, strontium, and barium salts by dissolving the oxides in the free acid. The lithium and barium salts both crystallize with one molecule of water, and their crystalline forms cannot be compared with the other members of their series. With the exception of the sodium salt which crystallizes in the hexagonal system, the salts of the other alkalies are tetragonal and isomorphous. The anhydrous salts of the alkaline earth group are probably orthorhombic.

Introductory Note on the Reduction of Metallic Oxides at High Temperatures. By Fanny R. M. Hitchcock. *J. Am. Chem. Soc.*, 20, 232–233.—This note states that nitrogen is given off from tungstic and molybdic oxides when reduced in a current of hydrogen.

Some Properties of Zirconium Dioxide. By F. P. Venable and A. W. Belden. *J. Am. Chem. Soc.*, 20, 273–276.—Ignited zirconia is practically insoluble in all acids except hydrofluoric, and is unattacked by heating with sodium carbonate. The specific gravity of an ignited sample was found to be 5.409. Determinations of water in zirconium hydroxide, which had been washed free from ammonia and with alcohol and ether, or with petroleum ether, gave figures which do not correspond to any definite degree of hydration, although when washed with petroleum ether approximately 26.00 per cent. of water remained. The hydroxide precipitated in the cold is insoluble in water, but readily soluble in dilute and strong hydrofluoric, hydrochloric, and hydrobromic acids. Oxalic acid dissolves it readily. When precipitated from a hot solution the solubility in acids is much decreased. Ammonia is without action on the hydroxide, but a saturated ammonium carbonate solution dissolves one part in a hundred. Varying quantities of carbon dioxide are taken up in the dry and moist conditions.

Ammonium Selenide. BY VICTOR LENHER AND EDGAR F. SMITH. *J. Am. Chem. Soc.*, **20**, 277–278.—A solution of five grams of ammonium molybdate in 50 cc. of water to which 20 cc. of strong ammonia had been added, was saturated with hydrogen sulphide; and the resulting deep red solution was concentrated in a vacuum over sulphuric acid. Black, anhydrous, orthorhombic prisms of ammonium selenide separated. The crystals, after they are freed from metallic selenium by extraction with carbon bisulphide, dissolve in water to a deep red solution, which precipitates selenides from neutral or alkaline solutions of metallic salts.

Action of Sulphur Monochloride upon Minerals. BY EDGAR F. SMITH. *J. Am. Chem. Soc.*, **20**, 289–293.—Sulphur monochloride reacts with many minerals with the formation of the chlorides of the metals present; with sulphides the sulphur of the mineral remains dissolved in the sulphur monochloride. The reaction is both oxidizing and substituting, and takes place with some minerals in the cold, while with others complete decomposition is accomplished only by heating.

Note on Liquid Phosphorus. BY F. P. VENABLE AND A. W. BELDEN. *J. Am. Chem. Soc.*, **20**, 303–304.—The authors have failed to obtain the liquid modification of phosphorus, previously described by Houston and Thompson.

The Oxyhalides of Zirconium. BY F. P. VENABLE AND CHARLES BASKERVILLE. *J. Am. Chem. Soc.*, **20**, 321–329.—The oxychloride, $ZrOCl_2.8H_2O$, crystallizes from water; and from its solution hydrochloric acid precipitates the salt $ZrOCl_2.6H_2O$. Either of these salts dried at 100°–125° in hydrochloric acid gas, forms the oxychloride, $ZrOCl_2.3H_2O$, which may also be formed by crystallizing a solution of zirconium hydroxide in hydrochloric acid. Oxybromides prepared by dissolving zirconium hydroxide in hydrobromic acid are described; but much difficulty was experienced in obtaining definite compounds on account of the tenacity with which the hydrobromic acid was held by the crystals. Salts represented by the formulas $ZrOBr_2.13H_2O$, $ZrOBr_2.14H_2O$, $ZrOBr_2.4H_2O$, $ZrBr(OH)_3.2H_2O$, and $ZrBr(OH)_3.H_2O$ are described, but the analytical data would indicate that some of them at least are not definite compounds, but merely transition forms. Gelatinous compounds were formed in several cases, but these were not studied.

ORGANIC CHEMISTRY.

J. F. NORRIS, REVIEWER.

On the Action of Acetic Anhydride on Phenylpropiolic Acid. BY ARTHUR MICHAEL AND JOHN E. BUCHER. *Am. Chem. J.*, **20**, 89–120.—It has been shown by the authors that acetic anhydride reacts with acetylenedicarboxylic acid to form the anhydride of acetoxylmaleïc acid, which gives oxalacetic acid on treatment with water. If acetic anhydride should react with phenylpropiolic acid in an analogous manner, the anhydride of β-acetoxylcinnamic acid would be formed, and this compound on decomposing with water would yield a β-hydroxycinnamic acid. As it seemed of theoretical interest to ascertain whether a product obtained in such a manner is identical with the benzoylacetic acid got by saponification of its esters, the above reaction was studied. The reaction took place in an entirely different way, however, a derivative of naphthalene being formed. When phenylpropiolic acid was heated with acetic anhydride, the anhydride of 1-phenyl-2,3-naphthalenedicarboxylic acid was formed, together with a small quantity of the mixed anhydride of acetic and phenylpropiolic acids. From its solution in alkalies the former is precipitated as the anhydride by acids. The sodium, barium, calcium, and silver salts, and the methyl ester of the acid were analyzed. By reduction of the anhydride, $C_{18}H_{10}O_2$, in alkaline solution with sodium amalgam, 1-phenyl-1,2,3,4-tetrahydro-2,3-naphthalenedicarboxylic acid was formed. Neutralized with ammonia its solution gave white crystalline precipitates with solutions of barium, calcium, and mercuric chlorides. Silver nitrate precipitated the salt $C_{18}H_{14}O_4Ag_2$. The anhydride of the acid was also prepared. When reduced in acetic acid solution the anhydride $C_{18}H_{10}O_3$ gave a lactone of the formula $C_{18}H_{12}O_2$, and when oxidized by potassium permanganate, 1-phenyl-2,3,5,6-benzenetetracarboxylic acid was formed. From the latter the silver, barium, calcium, and lead salts, the methyl and benzyl esters, and anhydride were prepared. When the barium salt of the acid was distilled with barium hydroxide diphenyl was obtained. A small amount of an acid isomeric with the above, which also yielded diphenyl when distilled with barium hydroxide, was obtained in the oxidation. The hydrocarbon obtained from the anhydride $C_{18}H_{10}O_3$ was shown to be α-phenylnaphthalene by oxidizing it to *o*-benzoylbenzoic acid. The authors point out the analogy between the formation of phenylnaphthalenedicarboxylic anhydride from phenylpropiolic acid and the formation of the isatropic acids from atropic acid (Fittig, *Ann. Chem.*, **206**, 34). They also offer explanations of the steps involved in the condensation of acetic anhydride and phenylpropiolic acid.

On the Conversion of Methylpyromucic Acid into Aldehydopyromucic and Dehydromucic Acids. BY H. B. HILL AND H. E. SAWYER. *Am. Chem. J.*, **20**, 169–179.—In order to establish experimentally the structure of dehydromucic acid, its synthesis from methylpyromucic acid was effected. Methylpyromucic acid was converted into ω-brommethylpyromucic acid, and the latter was changed into the dibrom derivative by the action of bromine in the sunlight. As the yield was small, methylpyromucyl chloride was made, treated with bromine, and the resulting ω-dibrompyromucyl bromide heated with water, when aldehydopyromucic acid was obtained. The phenylhydrazone and oxime of the latter acid were prepared. Aldehydopyromucic acid was readily converted by oxidation with silver oxide into dehydromucic acid.

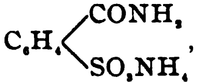
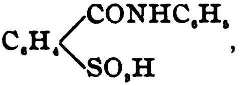
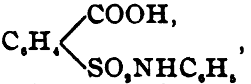
On the 3,4,5-Tribromaniline and Some Derivatives of Unsymmetrical Tribrombenzol. BY C. LORING JACKSON AND F. B. GALLIVAN. *Am. Chem. J.*, **20**, 179–189.—In the course of an attempt to prepare the vicinal tetrabrombenzene, which did not lead to the desired result, 3,4,5-tribromaniline was prepared. As its properties did not agree with those which had been assigned previously to a compound of this structure, the substance and a number of its derivatives were carefully studied. The structure of the compound was established by its preparation from *p*-nitraniline. The dibrom substitution-product was first prepared, the amido group was next replaced by bromine, and finally the nitro group was reduced. 3,4,5-tribromaniline melts at 118°–119° and forms a chloride, bromide, and sulphate which are more stable than the analogous salts of *s*-tribromaniline. The following derivatives were prepared: tribromphenylurethane, tribromacetanilide, tribromnitraniline NH_2,1,Br_3,3,4,5,NO_2,2, and the acetyl derivative of the last compound. In order to characterize more fully the 2,4,5-tribromaniline previously described by the authors (*Am. Chem. J.*, **18**, 247), derivatives similar to the above were studied. In their previous paper the authors state that tribromresorcine is the product of the action of sodium ethylate on tribromdinitrobenzene, Br_3,1,2,4; NO_2,3,5. The substance has been further studied and found to be tribromnitrophenetol.

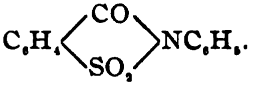
Direct Nitration of the Paraffins. BY R. A. WORSTALL. *Am. Chem. J.*, **20**, 202–217.—When normal hexane is boiled in an open flask with nitric acid (sp. gr. 1.42), or with a mixture of nitric and sulphuric acids, it is converted into nitro- and dinitrohexane. The best yield is obtained, however, when fuming acid is used. To separate the nitro-products, the reaction mixture is dried, and the unchanged hydrocarbon is distilled off. This is treated with more acid. By several days' successive treatment hexane was completely converted into nitro- and oxidation-products, the yield of crude nitro-compounds amounting to about 60 per cent. of the theoretical. Nitrohexane is best separated from the dinitro compound of distillation with steam, with which it is volatile. It was shown to be a primary compound by the application of the nitrolic acid test and was reduced to a primary amine. The dinitrohexane formed has probably the structure $CH_3(CH_2)_4CH(NO_2)_2$. It carbonizes on distillation, cannot be solidified by a mixture of ice and salt, and dissolves slowly in concentrated aqueous solutions of potassium and sodium hydroxide forming a deep red solution. Normal heptane is capable of more rapid nitration than hexane. Twenty hours' treatment with nitric acid (sp. gr. 1.42) gave about 20 per cent. of the theoretical yield. The action of a mixture of sulphuric and nitric acids yields a considerable amount of dinitroheptane which forms a layer between the nitroheptane and the acids. As the dinitro-compound yielded on reduction hydroxylamine and ammonia, probably it has the structure $CH_3(CH_2)_5CH(NO_2)_2$. Octane was studied in the same way and gave analogous results. All of the hydrocarbons yielded the same oxidation products; *viz.*, carbon dioxide, acetic, oxalic, and succinic acids. Carbon dioxide is the most abundant oxidation product. The quantity of other substances formed by boiling the hydrocarbons two days with nitric acid did not exceed two per cent.

On the Silver Salts of 4-Nitro-2-Aminobenzoic Acid and Its Behavior with Alkyl and Acyl Halides. By H. L. WHEELER AND BAYARD BARNES. *Am. Chem. J.*, **20**, 217–223.—The alkali salts of the aminobenzoic acids and the sodium salts of the acyl amides do not give esters directly with alkyl halides, as the alkyl groups attach themselves entirely or partially to nitrogen. As a direct replacement of the metal takes place with the silver salts of the amides, oxygen esters being formed, the action of acyl and alkyl halides on the silver salt of an aminobenzoic acid was studied to determine whether or not oxygen esters were formed in this case. 4-nitro-2-amino-benzoic acid was used, as its esters are solid. The silver salt of the acid gave, as the chief product with ethyl iodide in molecular proportions, 4-nitro-2-ethylaminobenzoic acid. Some 4-nitro-2-ethylaminobenzoic ethyl ester was formed, but no 4-nitro-2-aminobenzoic ethyl ester was observed. The behavior of the silver salt is therefore analogous to that of the sodium salts of the amine acids. Acetyl chloride reacted with the silver salts of anthranilic and 4-nitro-2 aminobenzoic acids forming compounds in which the acetyl group was joined to nitrogen. Since the above silver salts, in which the metal is joined to oxygen, give derivatives with acyl and alkyl halides containing the substituting group joined to nitrogen, it follows that the position of the metal in the salts or the amides cannot be determined by the structure of the reaction products, and that the sodium salts of the amides may have the metal joined to oxygen. The following substances are described: 4-nitro-2-acetaminobenzoic acid, and its sodium and silver salts; ethyl 4-nitro-2-acetaminobenzoate; 4-nitro-2-aminobenzoic acid, and its ammonium, sodium, and silver salts; methyl and ethyl 4-nitro-2-aminobenzoate; and 4-nitro-2-ethylaminobenzoic acid and its ethyl ester.

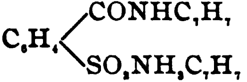
Formamide and Its Sodium and Silver Salts. BY PAUL C. FREER AND P. L. SHERMAN, JR. *Am. Chem. J.*, 20, 221–228. —The authors show that pure formamide cannot be prepared by Hofmann's method. The products of distillation of ammonium formate under ordinary pressure are formamide, water, ammonia, formic acid, ammonium formate, carbon monoxide, hydrocyanic acid, and ammonium cyanide. When distilled in a vacuum ammonium formate readily dissociates, and ammonia and formic acid pass into the distillate. In order to prevent this dissociation ammonium formate was heated to 180° in a current of dry ammonia. The resulting formamide was fractionated in an atmosphere of ammonia under a pressure of about one-half mm. The distillate, which boiled at 85°–95°, was colorless, oily, possessed a high index of refraction, reacted neutral towards litmus, and, when kept free from moisture, was stable. At —1° it solidified to a white crystalline mass of long, irregular needles. Its specific gravity at 4° was 1.16. Sodium formamide did not react with organic halogen compounds; and when dissolved in alcohol it gave with silver nitrate a silver derivative as a white, curdy precipitate. The orange-red silver salt of formamide described by Titherly (*J. Chem. Soc.*, 72, 460) was shown to be impure, the color being due to a trace of sodamide in the sodium salt from which it was prepared.

On the Decomposition of Diazo Compounds. XIII.—A Study of the Reaction of the Diazophenols and of the Salts of Chlor- and Bromdiazobenzene with Ethyl and Methyl Alcohol. BY FRANK KENNETH CAMERON. *Am. Chem. J.*, 20, 229–251.—This paper, the thirteenth from the laboratory of Johns Hopkins University on the diazo compounds, gives the results of an investigation of the influence of the hydroxyl group and the elements chlorine and bromine, when substituted in the benzene nucleus, in determining the decomposition of diazo compounds with ethyl and methyl alcohols. Paradiazophenol chloride was decomposed by methyl and ethyl alcohols in the presence of sulphuric and hydrochloric acids, potassium hydroxide, ammonia, and sulphur dioxide. In all cases the hydrogen reaction took place, phenol being formed. Meta- and orthodiazophenol chlorides gave the same result. Orthochlordiazobenzene salts with methyl and ethyl alcohols gave the hydrogen reaction alone. Metachlordiazobenzene salts with ethyl alcohol gave the hydrogen reaction, but with methyl alcohol the methoxy reaction predominated, metachloranisol being the principal product. Parachlordiazobenzene nitrate and ethyl alcohol gave principally the hydrogen reaction, but at the same time, to no inconsiderable extent, the ethoxy reaction, accompanied by the formation of chlornitrophenol. With methyl alcohol the same diazo compound gave the methoxy reaction and some chlornitrophenol. Parachlordiazobenzene sulphate with ethyl alcohol gave the hydrogen and with methyl alcohol the methoxy reaction. The bromdiazobenzene salts were studied in the same way and gave analogous results. From the above and other work on the diazo compounds the following conclusions are drawn: 1. The alkoxy reaction is normal; and the hydrogen reaction, when it takes place, is a modification induced by special conditions. 2. Regarding water as the first member of the series, the more complex the alcohol, the greater the tendency towards the hydrogen reaction. 3. Acid radicals, COOH, Cl, Br, NO_2, etc., induce the hydrogen reaction, and their influence is probably in the above order. 4. The presence of the substituting radical in the ortho position is most favorable to the hydrogen reaction, and in the meta position is more favorable than in the para.

An Investigation of Some Derivatives of Orthosulphobenzoic Anhydride. By Michael Druck Sohon. *Am. Chem. J.*, **20**, 257–278.—The anhydride of *o*-sulphobenzoic acid was prepared by heating molecular quantities of the acid potassium salt of the acid and phosphorus pentachloride. It is a well-characterized stable substance and crystallizes from benzene. The anhydride dissolves in methyl and ethyl alcohols forming acid esters from which the silver and potassium salts were prepared. By heating the anhydride with the following phenols at above 135° sulphonphthaleïns were formed: phenol, *o*-cresol, *p*-cresol, resorcinol, orcinol, hydroquinol, pyrogallol, *m*-amidophenol, and *p*-amidophenol. By the action of dry ammonia on the anhydride dissolved in ether, the ammonium salt of benzamidesulphonic acid,  $C_6H_4\left\langle\begin{matrix}CONH_2\\SO_2NH_4\end{matrix}\right.$, was formed. From the latter the potassium and barium salts were prepared, but it was impossible to obtain the free acid in crystalline condition. The anhydride reacts with aniline as it does with ammonia. The resulting anilido acid,  $C_6H_4\langle{}^{CONHC_6H_5}_{SO_3H}$, is a very soluble oil, whereas the isomeric sulphanilido acid,  $C_6H_4\langle{}^{COOH,}_{SO_2NHC_6H_5}$, is readily obtained in crystalline condition. The following salts of benzanilidosulphonic acid were prepared and analyzed: aniline, barium, ammonium, potassium, and cadmium. The sodium, copper, and lead salts evaporated to hard glasses and the silver salt decomposed on evaporation. By the action of phosphorus pentachloride on the potassium salt, he formed the anil,

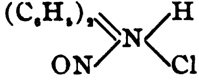


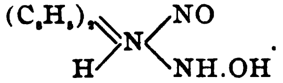
$$C_6H_4\langle{}^{CO}_{SO_2}\rangle NC_6H_5.$$

p- and *o*-toluidine reacted with the anhydride giving toluidine salts of benztoluidosulphonic acids,  $C_6H_4\langle{}^{CONHC_7H_7}_{SO_3NH_3C_7H_7}$. From these the barium and potassium salts were prepared. Benzamide and acetamide were converted into nitriles by the anhydride. Phosphorus pentachloride acting on the anhydride produced both chlorides of *o*-sulphobenzoic acid, the formation of the unsymmetrical chloride being favored by high temperature, continued action, and an excess of phosphorus pentachloride.

The Relation of Trivalent to Pentavalent Nitrogen. By Arthur Lachman. *Am. Chem. J.*, **20**, 283–288.—The author has undertaken a study of the conditions necessary for the existence of trivalent and pentavalent nitrogen and for the passage of one form into the other. In this preliminary communication the action of hydrochloric acid, zinc ethyl, and hydroxylamine on nitrosamines, $R_2{=}N{-}N{=}O$, is described. Dimethyl and diethylnitrosamines form unstable hydrochlorides which are decomposed when heated at 60° in a sealed tube. If a rapid stream of hydrochloric acid gas is passed into diethylnitrosamine, nitrosyl chloride passes off and diethylamine hydrochloride is formed. The analogous reaction between diphenylnitrosamine and hydrochloric acid gas (both carefully dried) was found to take place quantitatively according to the reaction

$$(C_6H_5)_2NNO + HCl = (C_6H_5)_2NH + NOCl.$$

It is probable that an unstable addition-product containing pentavalent nitrogen of the formula  $^{(C_6H_5)_2}_{ON}\rangle N\langle^{H}_{Cl}$ was first formed. Diphenylnitrosamine and zinc ethyl form a stable addition-product, which is decomposed by water or alcohol without evolution of a gas, the products being zinc hydroxide, diphenylamine, and an unstable base which reduces Fehling's solution. When diphenylnitrosamine and hydroxylamine, in molecular quantities, were boiled in methyl alcohol solution, either in the presence or absence of free alkali, nitrous oxide was given off in theoretical quantity. As no hyponitrites were formed the reaction can be explained only by assuming the direct decomposition of an addition-product of the following formula :



$$\begin{matrix}(C_6H_5)_2\\ H\end{matrix}\!>\!N\!<\!\begin{matrix}NO\\ NH.OH\end{matrix}.$$

From the above it is seen what limits exist for the stability of pentavalent nitrogen. A marked contrast in the chemical nature of a part of the five substituting groups is necessary to insure stability.

On Paramethoxyorthosulphobenzoic Acid and Some of Its Derivatives. By P. R. Moale. *Am. Chem. J.*, 20, 288–298.—*p*-Methoxy-*o*-sulphobenzoic acid was prepared by the method of Parks (*Am. Chem. J.*, 15, 320). In the treatment of *p*-methoxybenzoic sulphinide with dilute hydrochloric acid the free acid was formed and not the ammonium salt, which is the chief product of the reaction when benzoic sulphinide is decomposed by dilute acids. From the acid the neutral and acid calcium, magnesium, and lead salts and the acid potassium salt were prepared. Sulphonfluoresceïns were made by the action of resorcinol, orcinol, and phenol on the acid, but were not obtained in pure condition.

Decomposition of Paradiazoorthotoluenesulphonic Acid with Absolute Methyl Alcohol in the Presence of Certain Substances. By P. R. Moale. *Am. Chem. J.*, 20, 298–302.—When *p*-diazo-*o*-toluenesulphonic acid was decomposed by methyl alcohol in the presence of sodium methylate, the hydrogen reaction took place to a small extent, whereas with the alcohol alone only the methoxy product is formed. When the decomposition of the diazo compound was effected in the presence of sodium ethylate or potassium hydroxide, tarry masses were obtained from which no pure compounds could be isolated. With dry ammonia gas in methyl alcohol *p*-toluidine-*o*-sulphonic acid was obtained.

Parabenzoyldiphenylsulphone and Related Compounds. By Lyman C. Newell. *Am. Chem. J.*, 20, 302–318.—*p*-Toluenesulphone chloride was converted by means of the Friedel-Crafts reaction into *p*-tolylphenylsulphone, which was oxidized by chromic acid to *p*-phenylsulphonebenzoic acid. This acid forms well-characterized calcium, barium, and sodium salts and an acid chloride from which an amide and an anilide were prepared. *p*-Phenylsulphonebenzoyl chloride condenses with benzene in the presence of aluminium chloride forming *p*-benzoyldiphenylsulphone, a compound analogous to the one obtained in the same way by Remsen and Saunders (*Am. Chem. J.*, 17, 362) from the chlorides of *o*-sulphobenzoic acid. The para sulphone, unlike the corresponding ortho compound, is not decomposed into benzoic acid and diphenylsulphone when fused with potassium hydroxide. On the other hand it does yield a hydrazone and an oxime.

Derivatives of Silicon Tetrachloride. BY JOSEPH F. X. HAROLD. *J. Am. Chem. Soc.*, 20, 13–29.—With a view to developing some new analogies between the behavior of silicon tetrachloride and that of the tetrachlorides of the other elements of the fourth group in the periodic classification of the elements, its action on nitriles and aromatic amines was studied. It was found, however, that silicon tetrachloride did not react with hydrocyanic acid, benzonitrile, acetonitrile, tolunitrile, succinonitrile, chlorcyanogen, sulphur dichloride, nitrogen dioxide, or the chlorides of phosphorus, whereas the tetrachlorides of tin and titanium enter into reaction with these substances. Silicon tetrachloride and aniline gave a substance of the composition $SiCl_2(C_6H_5NH)_2$. With *o*-toluidine an analogous compound was formed. The chloride with benzamide gave benzaldehyde and with acetamide acetonitrile.

Preliminary Note on Some New Derivatives of Vanillin. BY A. E. MENKE AND W. B. BENTLEY. *J. Am. Chem. Soc.*, 20, 316–317.—By the action of sodium amalgam on chlorvanillin chlorvanilloin was formed. Nitric acid and vanillin yield three products: dinitroguiacol; a substance, which by further treatment with acid gives dinitroguiacol, and by oxidation with potassium permanganate nitrovanillic acid; and an unknown substance which was not identified. Tetrachlorpyrocatechin was formed when chlorine was passed into an alcoholic solution of pyrocatechuic acid.

Atropine Periodides and Iodomercurates. BY H. M. GORDIN AND A. B. PRESCOTT. *J. Am. Chem. Soc.*, 20, 329–338.—The conditions necessary for the formation of atropine enneaiodide were determined and applied to the volumetric estimation of the alkaloid. Atropine penta- and triiodide were also obtained. Double salts of the formulæ $C_{17}H_{23}NO_3HI.HgI_2$ and $(C_{17}H_{23}NO_3HI)_2.HgI_2$ were prepared and analyzed.

Chemical Bibliography of Morphine, 1875–1896. By H. E. Brown. *Pharm. Archives*, 1, 49–68.—This is a continuation of a bibliography of morphine, the appearance of which has already been noticed (*this Rev.*, 4, 13).

Alkyl Bismuth Iodides. By A. B. Prescott. *Pharm. Rev.*, 15, 219–220.—See *this Rev.*, 4, 49.

Formaldehyde. By George L. Taylor. *Am. J. Pharm.*, 70, 195–201.—The author gives a brief review of the methods of preparation and analysis and of the uses of formaldehyde.

[CONTRIBUTION FROM THE MASSACHUSETTS INSTITUTE OF TECHNOLOGY.]

REVIEW OF AMERICAN CHEMICAL RESEARCH.

VOL. IV. No. 8.

ARTHUR A. NOYES, Editor; HENRY P. TALBOT, Associate Editor.
REVIEWERS: Analytical Chemistry, H. P. Talbot and W. H. Walker; Biological Chemistry, W. R. Whitney; Carbohydrates, G. W. Rolfe; General Chemistry, A. A. Noyes; Geological and Mineralogical Chemistry, W. O. Crosby; Inorganic Chemistry, Henry Fay; Metallurgical Chemistry and Assaying, H. O. Hofman; Organic Chemistry, J. F. Norris; Physical Chemistry, H. M. Goodwin; Sanitary Chemistry, E. H. Richards; Technical Chemistry, A. H. Gill and F. H. Thorp.

GENERAL AND PHYSICAL CHEMISTRY.

A. A. NOYES, REVIEWER.

Electrical Disturbance in Weighing. BY H. K. MILLER. *J. Am. Chem. Soc.*, 20, 428–429.—The author finds that a flask wiped with a dry cloth shows an apparent increase in weight (in one case as much as 0.08 gram), and attributes this to the production of an electrical charge upon it, which induces an opposite charge in the floor of the balance case.

On the Speed of Coagulation of Colloid Solutions. BY C. E. LINEBARGER. *J. Am. Chem. Soc.*, 20, 375–380.—The author concludes from his experiments with ferric hydroxide, silicic acid, and egg albumen, that coagulation started in one part of a colloid solution does not necessarily spread through the whole body of it, and that therefore it is very improbable that colloid solutions are comparable with supersaturated solutions of crystalline substances.

The Decomposition of Sulphonic Ethers by Water, Acids and Salts. BY J. H. KASTLE, PAUL MURRILL AND JOS. C. FRAZER. *Am. Chem. J.*, 19, 894–901.—The ethyl ether of *p*-brombenzenesulphonic acid was dissolved in an excess of acetone, and 50 times the theoretical quantity of water in one case, and of alcohol in another, required for the saponification, was added to it; portions of these mixtures were heated in sealed tubes at 98° for different lengths of time (from 20 to 120 minutes), and the percentage decomposed was determined by titration with potash. Good velocity-constants of the first order were obtained, that for water being 3.5 times that for alcohol. It was found that acids and neutral salts, instead of merely acting catalytically, entered into a metathesis, the ethyl radical of the ester uniting with the acid radical of the acid or salt. The saponification and metathesis therefore occur simultaneously; and the authors have determined, at the ordinary and at the boiling temperature, the amount of each taking place in the presence of the three halogen acids, of potassium iodide, and of calcium and magnesium chlorides, 1 cc. of a normal or a half-normal solution of these substances being added to 4 cc. of an acetone solution of the ester. In almost all cases, the amount undergoing metathesis greatly exceeded that undergoing saponification. The authors regard the occurrence of the metathetical reaction as a new characteristic distinguishing the esters of sulphonic acids from those of the carbonic acids, in which latter, mineral acids in aqueous solution simply accelerate saponification. It seems quite probable, however, that the difference in behavior is due to the difference in the solvents, acetone being used for the sulphonic esters and water for the carbonic esters.

A Determination of the Atomic Weight of Praseodymium and of Neodymium. By Harry C. Jones. *Am. Chem. J.*, **20**, 345–358.—The material for the determination of the atomic weight of praseodymium was prepared by crystallizing 1½ kilos of fairly pure ammonium praseodymium nitrate presented by the Welsbach Light Company twenty-one times from a nitric acid solution, only the middle portion from each crystallization being taken. The metal was then precipitated by adding oxalic acid to the hot solution, in order to remove traces of iron, calcium, etc. The oxalate so obtained was found spectroscopically to contain only 0.06 per cent. of neodymium; but as traces of cerium and lanthanum were still present, the oxalate was ignited, the oxide dissolved in nitric acid, and the solution evaporated and poured into hot water, when a cloud of basic cerium nitrate separated. To remove the lanthanum, the double nitrate was again formed and recrystallized repeatedly from very strong nitric acid. Finally the metal was again precipitated as the oxalate, which was ignited forming the peroxide, and this was heated in hydrogen to reduce it to sesquioxide. The atomic weight determinations were made by adding concentrated sulphuric acid to the oxide in a platinum crucible, and heating it first gently and then above the boiling-point of the acid in an air-bath to a constant weight. In the case of neodymium, the methods used for purifying the material (which was obtained in the form of the double nitrate of ammonium and neodymium from the same source) and for determining the atomic weight of the element were almost identical with those just described. The average of twelve closely agreeing determinations was 140.45 in the case of praseodymium, and 143.60 in that of neodymium. It is remarkable that the values given by von Welsbach both differ from these by about three units and would agree well with them if interchanged, his values being 143.6 for praseodymium and 140.8 for neodymium.

On the Taste and Affinity of Acids. By J. H. Kastle. *Am. Chem. J.*, 20, 466–471.—The author found by experiments with nineteen different acids in $\frac{1}{50}$ normal solution on seventeen persons that in the great majority of cases one acid was pronounced more or less sour than another according as the affinity constant of the one was greater or less than that of the other.

The Equilibria of Stereoisomers, I and II. By Wilder D. Bancroft. *J. Phys. Chem.*, 2, 143–158; 245–255.—These papers discuss from a qualitative standpoint the application of the Law of Mass Action and the principle of freezing-point lowering to the equilibrium existing between two stereoisomers which undergo transformation into one another. In the first paper, the effect on the freezing-point of heating each of the stereoisomers by itself is considered; it is evident that a short heating will cause a lowering of the freezing-point of both of the pure compounds, owing to the formation of some of the other stereoisomeric modification; longer heating, near the melting temperature, will cause a further lowering, increasing in the case of one modification continuously until the liquid has the composition corresponding to the equilibrium-condition of the two stereoisomers, after which no further change in freezing-point occurs; while, in the case of the other modification, the freezing-point will steadily decrease on continued heating as long as it separates as a solid from the solution, but will suddenly begin to rise as the solution becomes so concentrated in the first modification as to cause *it* to separate, and will continue to rise until the former constant freezing-point corresponding to equilibrium is attained. In the second paper the effect is considered of the addition of a third substance not reacting chemically with the stereoisomers, for example, of the addition of a solvent. The author cites from the work of previous investigators numerous examples of some of the cases considered, showing them to be in accordance with his conclusions.

Acetaldoxime. By Hector R. Carveth. *J. Phys. Chem.*, 2, 159–167. **Benzilorthocarboxylic Acid.** By C. A. Soch. *J. Phys. Chem.*, 2, 364–370. **The Benzoyl Ester of Acethydroxamic Acid.** By Frank K. Cameron *J. Phys. Chem.*, 2, 376–381.—These articles are descriptions of experimental investigations of the stereoisomeric transformation of the substances mentioned in the titles along the lines indicated in the preceding review.

Naphthalene and Aqueous Acetone. By Hamilton P. Cady. *J. Phys. Chem.*, 2, 168–170.—Naphthalene in excess was added to seven different mixtures of acetone and water, and the composition of the solution was determined at the temperature at which it resolved itself into two liquid layers, the temperature being also noted.

Indicators. By John Waddell. *J. Phys. Chem.*, 2, 171–184.—The author shows that the addition of ether, benzene, or chloroform, and in some, but not in all cases, also of alcohol or acetone, to aqueous or alcoholic solutions in which the indicators fluorescein, phenacetolin, phenolphthalein, paranitrophenol, cyanine, methyl orange, turmeric, lacmoid, and corallin are present in the form of their salts causes a change in color to that of the free acid or base. This change of color takes place much more readily when the indicator is present in the form of its acetate than when in that of its hydrochloride, and when in the form of its ammonium salt than when in that of its potassium salt. The author apparently considers that the change of color is most probably explained by the assumption that the electrolytic dissociation of the salt to whose ion the color is due is greatly reduced by the organic solvents; but at the close of the article he raises two objections to this hypothesis; namely, first, that it is then necessary to assume that the undissociated indicator salt and acid or base of the indicator have just the same color in all the cases investigated; and, second, that the hypothesis does not offer any explanation of the fact that the salts of weak acids (acetic) or bases (ammonia) undergo the change so much more readily than those of strong acids and bases (like hydrochloric acid and potash). These objections seem to the reviewer to warrant completely the rejection of the above explanation; and it appears to him that the following one, which is in part suggested by the author himself, is far more probable: the very weak acids and bases of which indicators consist, are so much less dissociated in organic solvents than in water, that their salts become nearly completely hydrolyzed when these solvents are added to the aqueous solutions of the salts, in spite of the fact that the concentration of the ions of the water is also reduced somewhat; hence the addition of the solvents liberates the free indicator acid or base, which exhibits its usual color, and it will, of course, liberate it much more readily if the other component of the salt is also a weak base or acid.—By noting whether the change of color occurred on adding the solvents to the acid solution, or to the alkaline solution of the indicator, or to both solutions, the author was able to determine whether it acts as a base or as an acid, or as both. He concludes from his experiments that phenolphthalein, paranitrophenol, and turmeric are acids; that cyanine, methyl orange and lacmoid are bases; and that fluorescein, phenacetolin and corallin act both as acids and bases.

Benzene, Acetic Acid and Water. By JOHN WADDELL. *J. Phys. Chem.*, 2, 233–241.—This investigation is a continuation of the so-called "Mass Law Studies." See *this Rev.*, 3, 75, 152. No general conclusions are reached.

Boiling-Point Curve for Benzene and Alcohol. By E. F. THAYER. *J. Phys. Chem.*, 2, 382–384.—The author has determined by means of a molecular weight apparatus the boiling-point of various mixtures of benzene and alcohol. The boiling-point of benzene, 79°.5, was found to be lowered very rapidly by the first additions of alcohol, reaching 69° when seven per cent. of it was added. The boiling-points of the mixtures then remained fairly constant—between 69° and 67°—until about 70 per cent. of alcohol was present, after which they rose gradually up to that of pure alcohol, 78°. No reference is made to the extended investigations of Konowalow (*Wied. Ann.*, 14, 34, 219) in a similar direction.

Molecular Weights of Liquids. By CLARENCE L. SPEYERS. *J. Phys. Chem.*, 2, 347–361; 362–363.—The case of two miscible liquids, both of which have appreciable partial vapor-pressures, is considered with reference to the relation between the change in partial pressure of one liquid and the concentration of the other (expressed as the ratio of the number of mols of it to the total number present). Where proportionality exists between these two quantities, the author concludes that no association of molecules occurs. Where it does not exist, he thinks that there are errors in the observations or that association takes place.

H. M. GOODWIN, REVIEWER.

Spectroscope without Prisms or Gratings. By A. A. MICHELSON. *Am. J. Sci.*, 155, 215–217.—As is well known, the resolving power of a grating is proportional to the product of the total number of lines by the order of the spectrum observed. The great efficiency of the best modern gratings is due to the former factor almost exclusively, spectra of a higher order than the second or third being rarely observed. In the very beautiful device described by the author, the second factor is made of paramount importance, the spectra observed being of the order of several thousand. This is effected by observing the transmission spectrum produced by passing a beam of light from a collimater through a series of overlapping optically plane rectangular blocks of glass of equal thickness. These blocks must all be so nearly optically perfect that the accumulated error in the difference of path of light passing through the whole system shall not be a half wave-length. A system consisting of twenty elements 5 mm. thick would have a resolving power of 100,000, about equal to that of the best gratings. The great advantage of this arrangement over ordinary gratings is that all spectra are superimposed in a very high order, consequently the maximum possible brilliancy is obtained. The Zeeman effect was easily observed with an instrument constructed with but seven elements.

On the Surface Tension of Liquids under the Influence of Electrostatic Induction. BY SAMUEL J. BARNETT. *Phys. Rev.*, 6, 257–285.—The author has employed the beautiful method of ripples as perfected recently by Dorsey for investigating the change of surface tension of liquids with their degree of electrification, with the object of ascertaining whether the phenomenon is better explained by Helmholtz and Lippmann's or by Warburg's theory. The apparatus was modified in some details. Contrary to expectation, it was found that measurable effects could be produced only by very high electrification. This was affected by making the liquid surface one plate of an air condenser, the other being of glass coated with tin-foil and grounded. A Holtz machine served to charge the system. The potential was measured by applying the whole potential difference to the terminals of two condensers of known capacity, connected in series, and measuring the potential difference between the plates of one of them by means of a quadrant electrometer. Mercury and water were the two liquids investigated. It was found in all cases that the effect of electrification was to diminish the surface tension. The diminution was much greater in the case of water than in the case of mercury, but in both cases it was independent of the sign of the charge. A similar diminution in the apparent surface tension of water was also noted when alternating charges from the secondary of an induction coil was used. The author regards these results as being in accord with Helmholtz "charge" theory, but in disagreement with any electrolytic hypothesis. He points out, however, that the effect may possibly be wholly due to electrostatic actions in the liquid and not to "forces tangential to the surface acting between the elementary electric charges."

Normal Elements. BY D. MCINTOSH. *J. Phys. Chem.*, 2, 185–193.—Experiments were made with numerous cells, mostly of the Clark type, for the purpose of obtaining one with an electromotive force of about 0.5 volt and suitable for a standard of reference. The most promising consisted of $Pb/PbCl_2$, $ZnCl_2/Zn$. This cell has an electromotive force of 0.5 volt at 20° when the zinc chloride solution has a gravity of 1.23. Its temperature coefficient between 0° and 20° was found to be 0.0001 volt per degree. The electromotive force E in volts of the cell Cu/saturated $CuSO_4$, Hg_2SO_4/Hg was found to be as follows: $E = 0.3613 + 0.0006\ [16.5^\circ - t^\circ]$. A Pb/$PbCl_2$, HgCl/Hg cell failed to give satisfactory results. The attempt to reduce the effect of mechanical disturbances by the use of the agar-agar jelly proved unsuccessful with concentrated copper sulphate.

The Transference Number of Hydrogen. BY DOUGLAS MCINTOSH. *J. Phys. Chem.*, **2**, 273–289.—The method chosen for determining this quantity was that suggested by von Helmholtz and based on his theory of concentration cells. If the electromotive force of two cells of the type Zn/$ZnSO_4$, Hg_2SO_4/Hg of different concentrations, connected in opposition, that is, mercury to mercury, be compared with the electromotive force of the corresponding ordinary diffusion cell, Zn/$ZnSO_4$ concentrated, $ZnSO_4$ dilute/Zn, it is easy to show that the ratio of the former to the latter is equal to $\frac{v}{u+v}$, Hittorf's transference ratio. In order to determine the ratio for hydrogen in various acids, the electromotive force of gas batteries, with hydrogen electrodes, both with diffusion and without, was determined. Poggendorff's compensation method with the Lippmann electrometer was used for making the measurements. The mean value of the ratio $\frac{v}{u+v}$ was for hydrochloric acid 0.159, hydrobromic acid 0.158, hydriodic acid 0.161, sulphuric acid 0.174, and oxalic acid 0.163. The observed values of which the above are the mean were nearly independent of the dilution which varied from 1 to 1000 liters. This, together with the fact that the above values are much lower than Hittorf's values, leads the author to conclude that the method is inapplicable to gas cells, owing possibly to the solubility of hydrogen in the electrolyte. Certain other measurements on concentration cells with chlorine, bromine and iodine electrodes, led to results of no particular importance.

Single Differences of Potential. BY HECTOR R. CARVETH. *J. Phys. Chem.*, **2**, 289–322.—The object of this research "is to examine the theories of to-day with respect to single differences of potential ......, and to attempt to answer the question, Do these methods give the true potential difference?" A consideration of the theories of Helmholtz and of Warburg leads to the conclusion that an ideal dropping electrode is not realized in practice, owing to the fact that the dropping mercury does not assume in any case its maximum surface tension when falling into an electrolyte. Certain apparently discordant results of

Paschen lead the author to think that no potential difference between metal and liquid is accurately known. Notwithstanding his criticism of the dropping electrode method, the author makes use of it for investigating further the potential difference between a number of metals in solutions of their salts. It was found that fairly constant measurements could be obtained when the mercury broke below the surface of the liquid, but that the actual values varied widely with the adjustment of the electrode. A steady variation of potential with the dilution was observed in certain cases, but a comparison with the values computed from Nernst's theory was not satisfactory. Measurements of the potential difference between Hg/HgCl, KCl and between Hg/KCl agree well, if in the latter case the electrode was allowed to stand some time in contact with the electrolyte. In certain cases, contrary to Paschen's results, the potential difference was found to vary with the nature of the cation. Experiments on irreversible electrodes confirmed the results of Warburg and Paschen as to the effect of oxygen on the electrodes. Rothmund's results on the potential difference of amalgams are criticised, and the general conclusion is drawn from the whole investigation that "neither on the ground of Helmholtz's theory, nor that of Warburg, nor that of Nernst is there reason for regarding one single potential difference known."

Study of a Three-Component System. By HECTOR R. CARVETH. *J. Phys. Chem.*, 2, 209–229.—The author has determined the freezing-points of mixtures of lithium, sodium, and potassium nitrates, taken in pairs, and also when all three were simultaneously present. The measurements were made with a mercury thermometer, and an accuracy greater than one or two degrees was not attempted. The results are discussed graphically by the triangular diagram of Roozeboom, and the regions representing systems of different variance are determined. An approximate computation of the molecular weight of one inorganic salt dissolved in another, from the lowering of the melting-point produced, shows it to be much lower than ordinarily assumed, and to be largely dependent on the concentration.

Note on Thermal Equilibrium in Electrolysis. By D. TOMMASI. *J. Phys. Chem.*, 2, 229–232. From the decomposition-products observed in the electrolyses of solutions of several nitrates, nitrites, chlorates, sulphates, arsenates and arsenites between platinum electrodes placed very close together, the author concludes: "First, when a substance is submitted to two equal and contrary chemical actions, the reaction which involves the most heat will take place in preference, provided always that it can begin. Second, of two chemical reactions, that one which requires less heat to start it will always take place in preference, even though it evolves less heat than the other reaction."

The Specific Heat of Anhydrous Liquid Ammonia. By Louis A. Elleau and William D. Ennis. *J. Franklin Inst.*, 145, 189–214; 280–294.—The authors obtain the value 1.0206 for the mean specific heat of liquid ammonia between 0° and 20°. This is the mean of nine determinations made by the method of mixtures. The liquid ammonia, about 12 grams, was contained in a closed steel cylinder, and was initially cooled in a chamber surrounded by ice to nearly 0° before immersion in the calorimeter. The ammonia used was once distilled from the commercial product.

ANALYTICAL CHEMISTRY.

ULTIMATE ANALYSIS.

H. P. Talbot, Reviewer.

The Moist Combustion Method of Determining Carbon. By George Auchy. *J. Am. Chem. Soc.*, 20, 243–253.—The data given in this article indicate that, in the moist combustion method, a single potash bulb containing a potash solution of 1.27 sp. gr. is insufficient to insure the complete retention of the carbon dioxide evolved, and the substitution of a solution of 1.40 sp. gr. does not always obviate the necessity for a second potash bulb. It is also shown that a change in weight of the bulbs, due to loss or gain of moisture, must be carefully guarded against. The author finds the occasional absorption by the potash bulbs of some chloro-chromic compound which passes the purifying train, the most serious source of error in this procedure.

Electrolytic Determinations. By Edgar F. Smith and Daniel L. Wallace. *J. Am. Chem. Soc.*, 20, 279–281.—The authors confirm statements previously made regarding the electrolytic determination of uranium (*Am. Chem. J.*, 1, 329), and cadmium (*this Rev.*, 4, 30). They also controvert the statements of Heidenreich (*Ber.*, 29, 1587), who claims to have found their previous directions to be inaccurate.

Boric Acid Determination. By Thomas S. Gladding. *J. Am. Chem. Soc.*, 20, 288–289.—The procedure includes the distillation of the boric acid in the presence of sirupy phosphoric acid and methyl alcohol. The acid is titrated in the distillate after the addition of glycerine. A cut shows the details of the apparatus employed.

On the Determination of Potash without the Previous Removal of Iron, Cadmium, Etc. By C. C. Moore. *J. Am. Chem. Soc.*, 20, 340–343.—The usual procedure is much shortened by the addition of the hydrochloroplatinic acid to the acid solution of the substance, after filtration from any insoluble residue. The platinum compound is added only in sufficient quantity to combine with the potash, and, after evaporation almost to dryness, the double potassium-platinum salt is washed with acidulated alcohol (made by passing dry hydrochloric acid gas into cool ninety per cent. alcohol), then with ammonium chloride solution and finally with eighty-five per cent. alcohol. The double salt is then dried and weighed. Ammoniacal salts must first be destroyed.

Analytical Notes upon the Estimation of Phosphorus in Steel. By R. W. Mahon. *J. Am. Chem. Soc.*, 20, 429–453.—The molybdate-magnesia method for the determination of phosphorus in steels is critically examined by the author, and experimental data are given in profusion. A table of contents at the opening of the paper shows the division and scope of the subject-matter.

The Colorimetric Estimation of Small Amounts of Chromium, with Special Reference to the Analysis of Rocks and Ores. By W. F. Hillebrand. *J. Am. Chem. Soc.*, 20, 454–460.—The rock or ore is fused with sodium carbonate and nitrate, the manganese reduced by methyl or ethyl alcohol, the silica and aluminum removed (and re-examined for chromium), and if the amount of chromium is very small, mercurous nitrate added to throw down phosphoric, vanadic, chromic and carbonic acids in combination with mercury. This precipitate is ignited and the residue fused with sodium carbonate and the color of the solution compared with that of a standard chromate solution, made alkaline with sodium carbonate. Details as to apparatus are given in the original paper. The procedure exceeds in accuracy the usual gravimetric process.

Volumetric Estimation of Vanadium in Presence of Small Amounts of Chromium, with Special Reference to the Analysis of Rocks and Ores. By W. F. Hillebrand. *J. Am. Chem. Soc.*, 20, 461–465.—The rock or ore is treated exactly as described in the preceding review for the colorimetric estimation of chromium. The chromate solution may then be made acid with sulphuric acid and the chromic and vanadic acids reduced by sulphurous acid gas, the excess being expelled by boiling. The vanadium is then determined by titration with potassium permanganate. A considerable quantity of chromium, or the presence of arsenic or molybdenum, interferes with the titration.

[Contribution from the Massachusetts Institute of Technology.]

REVIEW OF AMERICAN CHEMICAL RESEARCH.

Vol. IV. No. 9.

Arthur A. Noyes, Editor; Henry P. Talbot, Associate Editor.
Reviewers: Analytical Chemistry, H. P. Talbot and W. H. Walker; Biological Chemistry, W. R. Whitney; Carbohydrates, G. W. Rolfe; General Chemistry, A. A. Noyes; Geological and Mineralogical Chemistry, W. O. Crosby; Inorganic Chemistry, Henry Fay; Metallurgical Chemistry and Assaying, H. O. Hofman; Organic Chemistry, J. F. Norris; Physical Chemistry, H. M. Goodwin; Sanitary Chemistry, E. H. Richards; Technical Chemistry, A. H. Gill and F. H. Thorp.

TECHNICAL CHEMISTRY.

F. H. Thorp, Reviewer.

The Protection of Steam-Heated Surfaces. By C. L. Norton. *Engineer, No.* 459, 165.—This investigation was made in order to show the relative efficiency of various kinds of steam-pipe covering now on the market, to ascertain the fire risk attendant upon the use of certain methods and materials for insulating steam-pipes, and to show the gain in economy attendant upon increase in thickness of coverings. A piece of steam-pipe was electrically heated from the inside, the electrical energy supplied was measured, and the amount of heat furnished was calculated. By keeping the pipe at a constant temperature, the amount of heat supplied is obviously equal to the heat lost by radiation, convection, and conduction. The pipe, closed at one end by a welded-in plate and at the other by a tight cover, was filled with heavy cylinder oil, into which the heating coil, an effective stirrer, and a thermometer, were introduced. The apparatus was suspended in the middle of a room, by non-conducting cords, and the thermometer was read by a telescope, the observer being at a distance to avoid the production of air currents and the addition of heat from the person. Fourteen different samples were tested, the best results being obtained with a covering composed of granulated cork pressed in a mould and rendered non-combustible by a fire-proofing process. Nearly as good was a covering composed of 90 per cent. magnesium carbonate. A cover made of thin sheets of asbestos paper, separated from one another so as to enclose a considerable amount of air, was also very effective. Asbestos, when not porous and not containing entrapped air, is a good conductor of heat. Carbonate and sulphate of calcium are not good heat insulators. Coverings containing wool, hair-felt, or wool-felt, have high efficiency as non-conductors, but are considered dangerous on account of fire risks. Computations of the money saving effected by covers, show that in general a cover pays for itself in a little less than a year of 310 ten-hour days; or in four months, working 365 days of twenty-four hours each. As a protection to wooden surfaces, an asbestos board, made of corrugated asbestos paper sheets cemented with sodium silicate, was found very effective, though not remarkable as a non-conductor of heat.

Sadtler's Reducing Agent. *Leather Manufacturer*, **9**, 105.—These are merely general remarks upon the use of hydrogen peroxide as a reducing agent for chrome tanned skins (see *this Rev.*, **2**, 106). A slightly acid bath is used, the peroxide being added in successive small portions.

Commercial "Moellon" Degras. *Leather Manufacturer*, **9**, 110.—Moellon is a degras made by the oxidation of cod or fish oil in the pores of skins from which the degras is then pressed. Abstracts of the various methods for preparing moellon, with a few remarks upon its use in tanning, make up the larger part of this article.

The Liming of Soils. BY H. J. WHEELER. *U. S. Dept. Agr., Farmers' Bull. No.* 77.—This bulletin gives a popular exposition of the theory and practice of using lime as a fertilizer. The various materials employed are described and their relative values compared. Many of the conclusions are drawn from the results of experiments at the Rhode Island Experiment Station where the author is the chemist.

Commercial Fertilizers. *N. Y. State Sta. Bull.*, **129**, 351–421; *Miss. Sta. Special Bull.*, **42** and **45**; *La. Sta. Bull.*, **49**, 163–198; *R. I. Sta. Rep.*, *1896*, 211–220; *N. J. Bull.*, **124**, 48; *Ark. Sta. Rep.*, *1897*, 101–118; *Md. Sta. Bull.*, **49**, 105–160; *Pa. Dept. Agr. Bull.*, 33; *Vt. Sta. Rep.*, *1896–97*, 28–30; *Ga. Dept. Agr. Bull.*, **33**, 116; *Me. Sta. Bull.*, **38**.

The Control of the Temperature in Wine Fermentation. BY A. P. HAYNE. *Cal. Sta. Bull.*, **117**, 19.—The causes of the spontaneous heating of fermenting must and methods of controlling it are considered in this bulletin. If the temperature exceeds 100° F. the wine ferment becomes inactive; but injurious bacteria continue to thrive. A method of cooling must, employed in France, is described, in which the must is pumped through several hundred feet of 1½ inch piping arranged in columns and cooled externally by water dripping upon the pipes from a tank above them. At the California Experiment Station a column composed of flat tubes 4 by 1½ inches is used, the total length of pipe being only 43 feet. The pipes are cooled by a spray of water blown against them by a strong blast of air, the evaporation adding greatly to the cooling effect.

Petroleum Briquettes in Germany. BY MAX BOUCHSEIN. *U. S. Consular Rep.*, 57, 254.—This is a description of a process patented by J. Kohlendorfer, by which petroleum refuse is worked into a solid substance for a cheap fuel. Soda lye and a saponifiable fat (such as tallow) are heated with superheated steam with exclusion of air until the saponification begins and then a fourfold quantity of petroleum refuse is added, and the mixture heated about an hour, with constant stirring, but keeping the temperature below the boiling-point of the petroleum. The mixture is then run into molds and solidifies on cooling. Coal-dust, saw-dust, or other combustibles may be added during the process if desired. The grease may be replaced by resin or resin acid if a harder product is desired. The product contains about 80 per cent. of petroleum oil and only 5 per cent. of noncombustible matter.

GEOLOGICAL AND MINERALOGICAL CHEMISTRY.

W. O. CROSBY, REVIEWER.

Auriferous Conglomerate of the Transvaal. BY GEO. F. BECKER. *Am. J. Sci.*, 155, 193–208.—The auriferous conglomerate of the Witwatersrand gold field constitutes the most important gold deposit ever known. A strip of country a couple of miles in width and about 30 miles in length has yielded since 1887 about $240,000,000, and only about one-fifteenth of the accessible gold has been extracted. The nature of this wonderful deposit is a subject of manifest interest to geologists and mining engineers, who, however, have arrived at various conclusions. No considerable doubt exists that the conglomerate is a marine littoral deposit, but some observers have held that the gold is detrital, being an original part of the conglomerate; others that it is a chemical precipitate from the ocean in which the pebbly beds were laid down; and still others that the precious metal reached the uplifted but uncemented gravel in solution, so that the ore-bearing strata are allied to ordinary veins. After presenting all the more striking facts which it is necessary to consider in testing the theories propounded to account for the deposition of gold on the Rand, the author rigidly tests each theory by the facts and reaches the conclusion that the deposition of the gold was in no sense chemical, that there are no valid objections to the theory of marine placer origin, and that no noteworthy features are left unexplained by this theory. The argument is so clear and cogent that the detrital theory of the Transvaal gold may be regarded as firmly established.

San Angelo Meteorite. By H. L. Preston. *Am. J. Sci.*, 155, 269–272.—This describes a metallic meteorite found in 1897, in Tom Green County, Texas. It weighed 194 pounds, and is distinguished by unusually perfect octahedral structure, the comparative scarcity of troilite, and the sharpness and regularity of the Widmanstätten figures. Analysis shows: Fe, 91.958; Ni, 7.860; and traces of Co, Cu, P, S, Si, and C.

On Clinohedrite, a New Mineral from Franklin, N. J. By S. L. Penfield and H. W. Foote. *Am. J. Sci.*, 155, 289–293.—This is a monoclinic hydrous silicate of zinc and calcium. The crystals are especially interesting, as they belong to that division of the monoclinic system characterized by a plane of symmetry but not an axis of symmetry. The theoretical composition as deduced from two analyses is: SiO_2, 27.92; ZnO, 37.67; CaO, 26.04; H_2O, 8.37: total, 100.00. This corresponds very nearly to the ratio 1 : 1 : 1 : 1, giving the formula $H_2ZnCaSiO_5$, analogous to that of calamine. The formula may also be written $(ZnOH)(CaOH).SiO_3$; and that hydroxyl is present is proved by the fact that water is not expelled much below a faint redness.

On Rhodolite, a New Variety of Garnet. By W. E. Hidden and J. H. Pratt. *Am. J. Sci.*, 155, 294–296.—This garnet, found in a very limited area in Macon County, North Carolina, is distinguished by its strikingly beautiful rose tints; its surprisingly small amount of coloring-matter; its gem-like transparency; its freedom from internal imperfections; and its remarkable brilliancy when cut as a gem. As yet it is known only as rolled pebbles and fragments in gravel. Analysis gives: SiO_2, 41.59; Al_2O_3, 23.13; Fe_2O_3, 1.90: FeO, 15.55; MgO, 17.23; CaO, 0.92; total, 100.32. The ratio of protoxide, sesquioxide and silica is nearly 3 : 1 : 3, which classifies the mineral as one of the garnets. The ratio of MgO to FeO is almost exactly 2 : 1, which would indicate that the mineral is composed of two molecules of a magnesium-aluminum garnet (pyrope) and one molecule of a ferrous iron-aluminum garnet (almandite). The theoretical composition is calculated for this ratio and the formula deduced.

Some Lava Flows of the Western Slope of the Sierra Nevada, California. By F. Leslie Ransome. *Am. J. Sci.*, 155, 355–375.—The lavas here described occur in the valley of the Stanislaus river and are of later date than the rhyolite and the andesitic breccias and tuffs of the region. The distinctive chemical feature of these rocks is a rather high percentage of total alkalies, with the potash somewhat in excess of the soda. Chemically they stand between typical andesites and typical trachytes, and belong to a group which it seems necessary to classify under a new name, and they are here called *latite*. Three successive flows are recognized, the first of which, the Table Mountain flow, extended a distance of at least twenty miles. The first and third flows are augite-latite, and the second, biotite-augite-latite. Seven analyses are given, and many others of allied rocks are quoted in tabular form for comparison. The potash approximates 5 per cent., and yet the majority of the thin sections contain no recognizable potash-bearing mineral. Hence the author concludes that where biotite is absent the potash must exist in the residual glass of the ground mass. The classification of the latites is discussed at some length and their lithologic individuality definitely established.

On Krennerite, from Cripple Creek, Colorado. BY ALBERT H. CHESTER. *Am. J. Sci.*, **155**, 375–377.—Krennerite has not previously been identified from this country. The mineral from Cripple Creek occurs in brilliant, orthorhombic crystals of a pale yellowish-bronze color, but tin-white on cleavage faces, and up to 2 mm. in length. An analysis by Prof. W. S. Myers gave, after deducting 1.21 per cent. of insoluble matter and calculating to one hundred: Au, 43.86; Ag, 0.46; Te, 55.68; corresponding to the formula $AuTe_2$, and agreeing very closely with sylvanite (monoclinic) and calaverite (triclinic).

Geology of the St. Croix Dalles. Part II.—Mineralogy. BY CHAS. P. BERKEY. *Am. Geol.*, **21**, 139–155.—The article describes (p. 153) a greenish-yellow sulphate occurring as an efflorescence on the pyritiferous Dresbach shales. Analysis gave: SiO_2, 12.946; Fe_2O_3, 22.828; Al_2O_3, 4.141; K_2O, 1.844; Na_2O, 4.659; CaO, 2.210; SO_3, 32.500; H_2O, 17.840; organic matter, traces; total, 98.968 per cent. Although probably a mixed substance, as indicated by the high proportion of silica, it is similar in complexity and general range to voltaite.

Residual Concentration by Weathering as a Mode of Genesis of Iron Ores. BY JAMES P. KIMBALL. *Am. Geol.*, **21**, 155–163.—After citing his previous papers on this subject, two of which have been noticed in this *Review*, the author describes a remarkable differential development of ferric and magnetic oxides from an amorphous basic aggregate on a tributary of the Yakima River, in the state of Washington. The ferruginous beds have a thickness of from six to eighteen feet; the chief occurrence of iron ores is at the base, where they overlie crystalline pyroxene; and here its development is confined to wet places and exposed ledges. In circumstances thus favorable to atmospheric oxidation and percolation of water, magnetite, martite, hematite, and limonite have been exfoliated as an insoluble residuum from decomposition of the basic aggregate, with interlaminated siliceous residuums, to a thickness of from two to eighteen inches; while immediately beneath the basal pyroxene is to the depth of a few inches, commonly decomposed into a soft chloritic clay. The ferriferous zone fades out gradually upward, and the whole occurrence is economically insignificant and worthless. Seventeen partial analyses by Prof. James A. Dodge show a range in metallic iron from 15.36 to 63.05 per cent. The fixation of ferric oxide is believed to occur through reaction with calcic carbonate, which is also a product of the splitting up of basic silicates. The magnetite is not regarded as wholly residual, but due in part to stoichiometrical transformation of ferric hydrate at ordinary temperatures.

Brazilian Evidence on the Genesis of the Diamond. BY ORVILLE A. DERBY. *J. Geol.*, 6, 121–146.—This is a very complete summary of the facts afforded by the diamond washings of Brazil that have a bearing upon the origin of this gem; and a comparison with the evidence from the "dry diggings" of South Africa. The general conclusion reached is that as the case now stands the indications support the view of the formation of the Brazilian diamonds in the phyllites or associated sedimentary deposits through the active agency of neighboring eruptives which are in part pegmatitic, the carbon having been supplied by the phyllites. In order to bring the Kimberley and Brazilian modes of occurrence into line as phases of a single mode of genesis, it seems necessary to put aside the idea that the recent interesting experiments on the artificial production of the diamond afford a solution of its terrestrial origin, and that the Kimberley type of rock and mode of occurrence are essential features. Presumably, also, the genesis must be sought in the rocks affected by the eruptive masses rather than in those masses themselves; and hence the diamond is to be regarded as of metamorphic, and not of truly igneous origin.

[Contribution from the Massachusetts Institute of Technology.]

REVIEW OF AMERICAN CHEMICAL RESEARCH.

Vol. IV. No. 10.

Arthur A. Noyes, Editor; Henry P. Talbot, Associate Editor.
Reviewers: Analytical Chemistry, H. P. Talbot and W. H. Walker; Biological Chemistry, W. R. Whitney; Carbohydrates, G. W. Rolfe; General Chemistry, A. A. Noyes; Geological and Mineralogical Chemistry, W. O. Crosby; Inorganic Chemistry, Henry Fay; Metallurgical Chemistry and Assaying, H. O. Hofman; Organic Chemistry, J. F. Norris; Physical Chemistry, H. M. Goodwin; Sanitary Chemistry, E. H. Richards; Technical Chemistry, A. H. Gill and F. H. Thorp.

INORGANIC CHEMISTRY.

Henry Fay, Reviewer.

The Action of Zinc on Copper Silicide. By G. de Chalmot. *Am. Chem. J.*, 20, 437–444.—In a previous paper (*this Rev.*, 4, 40) it was shown that sulphur decomposes copper silicide with the liberation of free silicon. It is now shown that zinc acts in a similar manner, setting free crystalline silicon. With the addition of small quantities of zinc, there is no liberation of silicon, owing to the fact that the zinc combines with the free copper in the silicide. By varying the amounts of zinc it has been estimated that the combination of the zinc and copper ceases when the two elements are present in the proportion to form the compound $ZnCu_2$, so that for the same quantities of zinc there is more silicon liberated the smaller is the quantity of free copper in the silicide.

The Action of Sulphur upon Metallic Sodium. By James Locke. *Am. Chem. J.*, 20, 592–594.—Sulphur in varying proportions dissolved in hot toluene, when brought into contact with sodium under boiling toluene, reacts to form a sulphide which, after washing with hot toluene, has approximately the composition expressed by the formula Na_2S_3. In two experiments where there was some residual sodium, it was bright and clear, showing that it was without action at this temperature on the polysulphide formed. At the temperature of melted naphthalene there was likewise combination; but there was no evidence in either case of the formation of sodium monosulphide.

On Some Compounds of Trivalent Vanadium. By James Locke and Gaston H. Edwards. *Am. Chem. J.*, 20, 594–

606.—The vanadates of sodium and ammonium were reduced by alcohol and hydrochloric acid to vanadyl dichloride, and this was further reduced to vanadium chloride by means of mercury amalgam in a special apparatus arranged so that all of the work could be carried out in a current of hydrogen. From vanadium hydroxide new salts were prepared so as to study the influence which the atomic weight exerts upon the development of the properties common to aluminum, chromium, manganese, iron, and cobalt. By evaporating *in vacuo* the green solution obtained by dissolving vanadium hydroxide in hydrochloric acid, crystals of the compound $VCl_3.6H_2O$ were obtained. This salt had previously been obtained by Piccini, but was not described by him. It is similar in composition and properties to the chloride of iron, aluminum, and chromium. Double salts could not be obtained from vanadium chloride and the alkali chlorides. The bromide, $VBr_3.6H_2O$, prepared in a similar manner, is described; but the iodide could not be obtained. Potassium vanadicyanide, $K_3V(CN)_6$, was prepared by dissolving the anhydrous chloride in as small a quantity of water as possible, and by adding to this an excess of a concentrated solution of potassium cyanide. From this solution the new compound was precipitated by the addition of alcohol. This salt forms a member of the series $K_3M(CN)_6$ and gives colored precipitates with solutions of inorganic salts. It was impossible to prepare the sodium and ammonium salts. Potassium vanadisulphocyanide, $K_3V(SCN)_6.4H_2O$, was made by bringing together vanadium trichloride and an alcoholic solution of potassium sulphocyanide and crystallizing in a vacuum. It crystallizes in dark-red crystals, which are readily soluble in water and alcohol, the solution, however, being extremely unstable.

On the Decomposition of Concentrated Sulphuric Acid by Mercury at Ordinary Temperatures. BY CHARLES BASKERVILLE AND F. W. MILLER. *J. Am. Chem. Soc.*, **20**, 515–517.—The authors state that the acid used by them in previous experiments contained 99.65 per cent. H_2SO_4, and that it does react with mercury, notwithstanding the evidence to the contrary cited by Pitman. (*This Rev.* 4, 41.)

BIOLOGICAL CHEMISTRY.

W. R. WHITNEY, REVIEWER.

Proteids of the Pea. BY THOMAS B. OSBORNE AND GEO. F. CAMPBELL. *J. Am. Chem. Soc.*, **20**, 348–362.—The authors have discovered that the legumin of the pea, previously described by them, was contaminated with another proteid, to which they have given the name vicilin; and that the purified legumin of the pea and of the vetch, lentil, and horse bean are probably identical. In the pea they recognize the following proteids: legumin, which is the non-coagulating globulin; vicilin, coagulable and relatively soluble; a globulin or albumin to which the name legumelin is given; protoproteose; and deuteroproteose. The results of analyses of these constituents and their properties are given.

Proteids of the Lentil. Proteids of the Horse Bean. Proteids of the Vetch. Proteids of the Soy Bean. By T. B. Osborne and G. F. Campbell. *J. Am. Chem. Soc.*, **20**, 362–375; 393–405; 406–410; 419–427.—In these four investigations the authors have followed the methods employed in the preceding one, and have arrived at conclusions concerning the composition of the nitrogen-containing components of these vegetables. They find legumin, legumelin, and proteose in the lentil, horse bean, and vetch, and vicilin in the lentil and horse bean. The soy bean contains as its chief proteid a globulin somewhat similar to the legumin found in the other vegetables examined, but of somewhat different composition. The soy bean also contains some legumelin and proteose.

The Proteids of the Pea, Lentil, Horse Bean, and Vetch. By T. B. Osborne and G. F. Campbell. *J. Am. Chem. Soc.*, **20**, 410–419.—The authors compare the compositions and properties of the legumin, vicilin, legumelin, and proteose which they have isolated from the vegetables mentioned in the title, and give the results of the application of the proteid tests upon these different constituents. The analyses of the four substances which they have obtained agree exceedingly well for the same substance from the different sources, while the differences between the compositions of the different proteids are very marked.

A. G. Woodman, Reviewer.

The Chemistry of Cascara Sagrada. By Alfred R. L. Dohme and Hermann Engelhardt. *J. Am. Chem. Soc.*, **20**, 534–546.—The authors have made a systematic analysis of a typical sample of cascara sagrada bark. They have obtained the volatile oil which gives to the drug its characteristic odor, and have also isolated a fixed oil which they regard as a mixture of dodecyl palmitate and dodecyl stearate. From the extract with eighty per cent. alcohol, was obtained the glucoside of cascara sagrada, which the authors have named purshianin. This is a dark brown-red crystalline substance which melts at 237° C., and yields emodin when saponified.

Nitrogenous Feeding Stuffs. BY C. S. PHELPS. *Storrs Agr. Expt. Sta. Bull.*, **18**, 1–16.—This bulletin describes a number of nitrogenous feeding stuffs, and contains tables showing their composition and nutritive value.

Mushrooms as Food. *U. S. Dept. of Agr., Farmers' Bull.*, **79**, 18-20—Tables are given comparing the composition of mushrooms with that of other articles of food. These show that edible fungi do not possess a high food value.

Evaporation and Plant Transpiration. BY WALTER MAXWELL. *J. Am. Chem. Soc.*, **20**, 469–483.—The object of this investigation was to determine, first, the loss of moisture due to direct evaporation from the soil; and secondly, the relative proportion that escapes by transpiration from the sugar-cane (*saccharum officinarum*) during different periods of growth. The observations were made on considerable quantities of soil, 125 pounds in each case, and covered a period of eight months. The author considers that it is shown by the results that nitrogen, which was applied in the form of sodium nitrate, stimulates growth and causes increased transpiration, and also that nitrogen is the vital element in the growth of plants. The data obtained were found to be of value in practical field irrigation.

Some Spraying Mixtures. *Cornell Univ. Agr. Expt. Sta. Bull.*, **149**.—This bulletin contains analyses of some mixtures sold as insecticides, most of them being found to contain arsenic and copper.

The Value of Experiments on the Metabolism of Matter and Energy. BY C. F. LANGWORTHY. *U. S. Dept. Agr. Expt. Sta. Record*, **9**, 1003–1019.—The author discusses the value of metabolism experiments in comparison with ordinary feeding tests, and advocates a more general trial of such experiments at experiment stations.

The Mineral Constituents of the Tubercle Bacilli. BY E. A. DE SCHWEINITZ AND MARION DORSET. *J. Am. Chem. Soc.*, **20**, 618–620.—In continuation of their work upon the composition of the tubercle bacilli, the authors have made careful analysis of the ash. Quite noticeable were the high percentage of phosphorus pentoxide and the absence of other acid radicals. The high percentage of fat in the body of the tubercle bacilli, as previously observed, taken in connection with the high phosphate content of the ash, lead the authors to raise the interesting query as to whether, in prescribing phosphates and cod-liver oil in cases of tuberculosis, we are not supplying nourishment to the bacilli rather than to the individual.

A Volumetric Assay of Opium. By H. M. Gordin and A. B. Prescott. *Pharm. Archives*, 1, 121–126.—The method is based on the following plan: The opium alkaloids are set free by ammonia with alcohol, ether, and chloroform. The other alkaloids are removed by benzene, after which the morphine is taken out by percolation with acetone. After evaporation of the acetone the residue is taken up with lime-water, and the morphine is estimated by titration as periodide, according to the method of the authors (*J. Am. Chem. Soc.*, 20, 334). The procedure is described in considerable detail.

Note upon the Volumetric Assay of Opium. By H. M. Gordin and A. B. Prescott. *Pharm. Rev.*, 16, 303.—The authors have found that in the estimation of morphine as a periodide by their method, as described in the preceding review, the character of the precipitate obtained varies under certain conditions, which are now being studied.

Factory Tests for Milk. By S. M. Babcock, H. L. Russell, and J. W. Decker. *Wis. Agr. Expt. Sta. Bull.*, 67, 1–20.—This bulletin describes a number of simple tests that can be applied to determine the quality of the milk with regard to its use in the cheese industry. It gives a quite thorough description of the Wisconsin Curd Test as used for this purpose.

The Chemistry of Aloes. By Alfred R. L. Dohme. *Am. J. Pharm.*, 70, 398–402.—This paper is a summary of recent work on the subject, showing (1) that the resin of aloes is an ester varying with the kind of aloes; (2) that aloin contains emodin, to which its laxative property is probably due; and (3) that many drugs owe their laxative property to the substance emodin, which is probably a derivative of hydroquinone.

Analyses of Commercial Fertilizers. *Agr. Expt. Sta. Bull., R. I., No.* 48; *S. C., No.* 35; *Vt., Nos.* 63, 64, and 65; *Ky., No.* 75; *Me., No.* 43.

Valuation of Crude Carbolic Acid. By Carl E. Smith. *Am. J. Pharm.*, 70, 369–378.—As the result of a number of experiments, the author concludes that a modification of Koppeschaar's bromine test, and a test for alkali, are all that is required to determine the value of a sample for disinfecting purposes.

On the Determination of Fat and Casein in Feces. By Herman Poole. *J. Am. Chem. Soc.*, 19, 877–881.—The author considers methods of fat determination by extraction with ether faulty, because no attempt is made to separate the fat from the cholesterol, bile, and other products extracted. He effects this separation by saponifying the residue from the evaporation of the ether extract with alcoholic potash, and extracting the aqueous solution of the resulting soap with ether to remove cholesterol. The remaining liquid is used for the determination of fat acids. In the determination of casein the chief difficulty lies in its separation from the epithelium cells and foreign matter. This the author effects by extracting the feces in succession with ether, water, and alcohol, and then drying. The residue is digested with dilute hydrochloric acid (1 : 2½) at 50°. This dissolves the casein and leaves the epithelium debris. The casein is calculated from the nitrogen determined by the Kjeldahl method. The results obtained are lower than those given by the old methods; but the author claims that they are nearer the truth.

Salt River Valley Soils. BY ROBERT H. FORBES. *Ariz. Agr. Expt. Sta. Bull.*, **28**, 66–99. — This bulletin contains the results of analyses made of the alkaline soils of Arizona, taken entirely from the surface, and in nearly all cases at a dry season of the year. A discussion of the object and value of soil analyses is also included.

Carbon Dioxide from Fermentation. BY DR. P. FISCHER. *Pharm. Rev.*, **16**, 214–220.—The author discusses the recovery of carbon dioxide from the fermentation of beer. 100 pounds of beer-wort will furnish about 4 pounds of carbon dioxide. Calculated on this basis the annual production in the United States, most of which, however, still escapes into the atmosphere, is more than 300,000,000 pounds. The process and plant used by the Pabst Brewing Company, of Milwaukee, is described. Here air-free gas is collected directly from the fermenting tubs, and is subsequently liquefied and purified. In 1897 this company sold over 1,500,000 pounds of the liquefied gas.

A Preliminary Report on the Soils of Florida. BY MILTON WHITNEY. *U. S. Dept. Agr.*, *Div. of Soils*, *Bull.* 13.—This report contains a brief description of the principal types of soil and the characteristic vegetation, and a discussion of the chemical composition, of the physical texture, and of the water content, with reference to the differences in agricultural value.

An Electrical Method of Determining the Moisture Content of Arable Soils. BY MILTON WHITNEY, FRANK D. GARDNER, AND LYMAN J. BRIGGS. *U. S. Dept. Agr.*, *Div. Soils*, *Bull.* **6**. —The principles of physical chemistry involved in the method are discussed, and a description and illustrations of the apparatus are given.

An Electrical Method of Determining the Temperature of Soils. By Milton Whitney and Lyman J. Briggs. *U. S. Dept. Agr., Div. Soils, Bull.* 7.

An Electrical Method of Determining the Soluble Salt Content of Soils. By Milton Whitney and Thos. H. Means. *U. S. Dept. Agr., Div. Soils, Bull.* 8.

Methods for the Examination of Milk. By Byron Stanton. *Ohio San. Bull.*, 2, 17–25.—This paper is a critical discussion and comparison of the various methods in use for detecting adulteration in milk. It does not contain anything new.

A Comparison of Utah Feeding Stuffs. By Luther Foster and Lewis A. Merrill. *Utah Agr. Expt. Sta. Bull.*, 54, 119–140.

Digestion Experiments with Shredded Corn-fodder, Lucern, Timothy, and Wheat Bran. By John A. Widtsoe. *Utah Agr. Expt. Sta. Bull.*, 54, 141–151.

Cotton and Corn Experiments. By C. C. Pittuck. *Tex. Agr. Expt. Sta. Bull.*, 45, 978-1008.

E. H. RICHARDS, REVIEWER.

Nutrition Investigations in Pittsburg. By Isabel Bevier. *U. S. Dept. Agr. Bull.*, 52, 1–48.—In the course of these studies a special point was made of the composition and cost of bread made at home in comparison with that purchased from bakeries. There is also a discussion of the apparent loss of nutrients during the process of baking.

Nutrition Investigations at the University of Tennessee in 1896 and 1897. By Chas. E. Wait. *U. S. Dept. Agr. Bull.*, 53, 1–46.—In addition to three dietaries this bulletin contains valuable data upon the composition of Tennessee beef, mutton, and chicken. There is also an account of twenty-one digestion experiments with men, from which it appears that, in the cases given, a diet of bread and beef yielded only 85.5 per cent. of the total energy in the food eaten; one of bread, milk, and eggs, 88.6; an average of 11 mixed diets, 89.9; while bread and milk alone returned 92.3 per cent. of the calculated energy. Although the time of the experiments—two days—was far too short for any very conclusive results, the facts have a certain value in the dearth of similar studies under American conditions.

Nutrition Investigations in New Mexico in 1897. By Arthur Goss. *U. S. Dept. Agr. Bull.*, 54, 1–20.—In addition to a dietary of a poor Mexican family, the author gives the analyses of the different cuts of a side of New Mexico range beef, which show the remarkable absence of fat in this class of meat when killed in the spring.

A Method for the Differentiation of Organic Matter in Water. BY A. G. WOODMAN. *J. Am. Chem. Soc.*, 20, 497–501.—The reagent used is potassium bichromate and the method is a modification of that given by Joseph Barnes, which is essentially the determination of the ratio between the amount of oxygen used up by potassium permanganate and by bichromate from the same water. The results given indicate that the method is worth further trial.

The Operation of a Slow Sand Filter. BY CHAS. E. FOWLER. *J. N. E. Water Works Assoc.*, *1898*, 209–244.

The Origin of Free and Albuminoid Ammonias in Polluted Waters. BY ELMER G. HORTON. *J. Am. Public Health Assoc.*, 23, 199–205.—The author discusses the decomposition of urea under the conditions obtaining in the distillation for ammonia.

The Public Water Supplies of the State. BY A. W. SHAFTER. *N. C. Board of Health, Bull.* 13, 2, 1–23.—The report includes a bacteriological and a partial chemical examination of the supply of 14 towns together with an examination of the watershed.

[CONTRIBUTION FROM THE MASSACHUSETTS INSTITUTE OF TECHNOLOGY.]

REVIEW OF AMERICAN CHEMICAL RESEARCH.

VOL. IV. NO. 11.

ARTHUR A. NOYES, Editor; HENRY P. TALBOT, Associate Editor.
REVIEWERS: Analytical Chemistry, H. P. Talbot and W. H. Walker; Biological Chemistry, W. R. Whitney; Carbohydrates, G. W. Rolfe; General Chemistry, A. A. Noyes; Geological and Mineralogical Chemistry, W. O. Crosby; Inorganic Chemistry, Henry Fay; Metallurgical Chemistry and Assaying, H. O. Hofman; Organic Chemistry, J. F. Norris; Physical Chemistry, H. M. Goodwin; Sanitary Chemistry, E. H. Richards; Technical Chemistry, A. H. Gill and F. H. Thorp.

GENERAL AND PHYSICAL CHEMISTRY.

A. A. NOYES, REVIEWER.

The Atomic Weight of Cadmium. BY H. N. MORSE AND H. B. ARBUCKLE. *Am. Chem. J.*, **20**, 536–542.—In order to determine any correction that may exist for the presence of retained gas in the cadmium oxide, the authors have repeated the atomic weight determinations of Morse and Jones (*Am. Chem. J.*, 14, 241) using essentially the same method and the same samples of cadmium. The gas evolved on dissolving the oxide was collected as in the authors' experiments with zinc oxide (*this Rev.*, 4, 55), and, as before, was found to be very appreciable in quantity, and to consist of oxygen and nitrogen. The uncorrected result, 112.084, is very close to that previously obtained, 112.071, while the corrected one, 112.377, now agrees well with those obtained by Bucher, 112.39 and 112.38, in his work on the chloride and bromide of cadmium.

A Table of Atomic Weights. BY THEODORE WILLIAM RICHARDS. *Am. Chem. J.*, **20**, 543–554.—The author has made a critical study of the reliability of the existing atomic weight determinations, and has compiled a new table of atomic weights. In the case of seven elements his values differ markedly from those of Clarke, as is shown below:

	Richards.	Clarke.
Antimony	120.0	120.43
Cadmium	112.3	111.95
Calcium	40.0	40.07
Magnesium	24.36	24.28
Platinum	195.2	194.89
Tungsten	184.4	184.83
Uranium	240.0	239.59

The Reliability of the Dissociation Values Determined by Electrical Conductivity Measurements. By Arthur A. Noyes. *J. Am. Chem. Soc.*, 20, 517–528.—The author endeavors to show that an error has been made by van Laar (*Ztschr. phys. Chem.*, 21, 79) in the derivation of his heat-of-solution formula, and that therefore his conclusion based thereon in regard to the unreliability of the dissociation values determined by electrical conductivity is entirely unjustifiable. The question is also discussed from several other points of view. Incidentally a new, rigidly exact and general expression is derived from the relation between the heat of solution of dissociated substances and the change in their solubility with the temperature.

Molecular Weights of Some Carbon Compounds; A Few Words More. By C. L. Speyers. *J. Am. Chem. Soc.*, 20, 546–547.—This note is a reply to the criticism by the reviewer of a previous article by the same author (*this Rev.*, 4, 55). In explanation of his presentation to his readers of several pages of numerical results without a word of discussion, the author states that he himself was at a loss to account for the peculiar results obtained. He rejects the suggestion of the reviewer as to the possibility of error from imperfect elasticity of the bulb.

The Atomic Mass and Derivatives of Selenium. By Victor Lenher. *J. Am. Chem. Soc.*, 20, 555–579.—A current of hydrochloric acid gas was passed over silver selenite, first in the cold, then at a general heat; the silver chloride formed was weighed, and reduced with hydrogen; and the residual silver again weighed. Eleven determinations of the ratio $Ag_2SeO_3 : 2AgCl$ gave 79.329 as the atomic weight of selenium and eight determinations of the ratio $Ag_2SeO_3 : 2Ag$ gave an identical value. From ammonium bromoselenate the selenium was precipitated by hydroxylamine hydrochloride, the precipitate collected on a Gooch filter and weighed. Eight determinations of the ratio $(NH_4)_2SeBr_6 : Se$ lead to the atomic weight 79.285. In conclusion, a large number of organic and inorganic bromoselenates are described; and evidence of the non-existence of a selenium monoxide is furnished by several experiments.

Osmotic Pressure. By C. L. Speyers. *J. Am. Chem. Soc.*, 20, 579–585.—The author attempts to show with the help of hypotheses relating to the constitution of solutions, that the specific gravity value which enters in the thermodynamical relation between osmotic pressure and vapor pressure is that of the pure solvent and not that of the solution. This conclusion had, however, already been reached by other authors. The author, to be sure, considers the mechanical arrangement involved in the demonstration of it recently given by Noyes and Abbot to be "purely imaginary and not possible in fact," and "the results depending on their theoretical deductions to be valueless."

ANALYTICAL CHEMISTRY.

ULTIMATE ANALYSIS.

W. H. WALKER, REVIEWER.

On the Lindo-Gladding Method of Determining Potash. BY A. L. WINTON AND H. J. WHEELER. *J. Am. Chem. Soc.*, **20**, 597–609.—With a view of meeting certain criticisms of the Lindo-Gladding method for determining potash, the authors have made an extensive study of the recent work bearing on the subject. Numerous data are presented which show that the objections made to the process are, so far as practical considerations go, without foundation.

On the Estimation of Manganese Separated as Carbonate. BY MARTHA AUSTIN. *Am. J. Sci.*, 155, 382–384.—The separation of manganous carbonate is shown to be both rapid and complete when made in a warm solution and in the presence of considerable ammonium chloride. The precipitate cannot, however, be weighed as carbonate, as carbon dioxide escapes before all the moisture has been expelled; but, by the addition of sulphuric acid and subsequent weighing as anhydrous sulphate (*this Rev.*, **4**, 60) an accurate determination can be made.

A New Volumetric Method for the Determination of Copper. BY RICHARD K. MEADE. *J. Am. Chem. Soc.*, **20**, 610–613.—A volumetric method for the determination of copper more accurate and also more widely applicable than either the cyanide or iodine method is found to be the following: The copper is precipitated from an acid solution by addition of ammonium or potassium thiocyanate, and the cuprous salt thus obtained converted to cuprous oxide by warming with potassium hydrate. To this is added a solution of ferric chloride or sulphate, and the ferrous salt formed by the oxidation of the cuprous oxide is then titrated with standard permanganate solution.

A Short Study of Methods for the Estimation of Sulphur in Coal. BY G. L. HEATH. *J. Am. Chem. Soc.*, **20**, 630–637.—The author makes a comparative study of the five more common methods for the determination of sulphur in coal, and notes such modifications and precautions as he finds necessary to obtaining the most accurate results.

On the Condition of Oxidation of Manganese Precipitated by the Chlorate Method. BY F. A. GOOCH AND MARTHA AUSTIN. *Am. J. Sci.*, 155, 260–268.—Although the "chlorate process" is at present the method most widely used by practical chemists for the separation of manganese, yet the degree of oxidation of the precipitated oxide has never been definitely determined. The author finds the more soluble sodium chlorate a better precipitant than the potassium salt, but that the precipitate produced by neither of these corresponds exactly to the dioxide, MnO_2. A procedure is given by which the precipitate can be made to correspond to the formula, but it is not recommended by the authors as a rapid analytical method.

F. J. MOORE, REVIEWER.

Use of Hydrofluoric Acid in the Determination of Manganese in Iron and Ores. BY ALLEN P. FORD AND I. M. BREGOWSKI. *J. Am. Chem. Soc.*, 20, 504–506.—An objection to the Williams method is the clogging of the filter by separated silicon. This may be completely dissolved and the filtration accelerated by the addition of a few drops of hydrofluoric acid just after the precipitation of the manganese peroxide. In the analysis of ores by this method, the presence of hydrofluoric acid has the peculiar effect of making the precipitation more complete, thus rendering a second precipitation unnecessary.

The Determination of Lead in Alloys. BY W. E. GARRIGUES. *J. Am. Chem. Soc.*, 20, 508–510.—Lead may be separated from copper and zinc by precipitation as chromate in ammoniacal solution. The following separation of lead from tin is outlined: The alloy is decomposed by nitric acid, the metastannic acid is dissolved in concentrated sulphuric acid, and, after specified dilution, filtered off from the insoluble lead sulphate.

Inaccuracies in the Determination of Carbon and Hydrogen of Combustion. BY CHARLES F. MABERY. *J. Am. Chem. Soc.*, 20, 510–513.—The author enumerates four important sources of error: inefficiency of the purifying train; loss of gaseous hydrocarbons; imperfect absorption of carbon dioxide; and loss of moisture from the potash bulb. A statement of how the difficulties may be overcome is postponed till the completion of work now on hand.

Some Further Applications of Hydrogen Peroxide to Quantitative Analysis. BY PERCY H. WALKER. *J. Am. Chem. Soc.*, 20, 513–515.—Hydrogen peroxide prevents the precipitation of titanium by ammonia and of uranium by sodium hydroxide.

This affords a means of separation of both metals from iron, and of uranium from zirconium.

The Error in Carbon Determinations Made with the Use of Weighed Potash Bulbs. BY GEORGE AUCHY. *J. Am. Chem. Soc.*, **20**, 528–534.—In a series of combustions, sulphuric acid bulbs were used to determine the amount of moisture carried over from the prolong of the potash bulbs. Some anomalous results obtained were traced to the condensation of moisture upon the outside of the bulbs. It was found that the error from this source may, in moist weather, exceed that caused by neglecting to use the sulphuric acid bulbs at all. Furthermore, this error cannot be compensated for by the use of tared bulbs, as the condensation proceeds with utter irregularity under apparently similar conditions. This renders true blanks in damp weather impossible. The conclusions reached are supported by a large amount of experimental data.

Note on Drown's Method of Determining Silicon in Steel. BY GEORGE AUCHY. *J. Am. Chem. Soc.*, **20**, 547–549.—The author modifies Drown's method by conducting the evaporation with aqua regia and sulphuric acid, instead of sulphuric and nitric acids. He claims a gain in accuracy as well as practical convenience.

Electrolytic Determination of Tin in Tin Ores. BY E. D. CAMPBELL AND E. C. CHAMPION. *J. Am. Chem. Soc.*, **20**, 687–690.—Tin ores are decomposed by fusion with sodium carbonate and sulphur, the resulting sulphostannate transformed to the double oxalate of tin and ammonia, and the latter electrolyzed. The transformation to the double oxalate is accomplished as follows: The sulphostannate solution is neutralized with hydrochloric acid, and sodium peroxide is added. This oxidizes the tin to stannic chloride. The sulphur is now filtered out, and ammonia and ammonium oxalate are added to the solution. From the solution so obtained the tin is satisfactorily deposited by a current of 0.10 ampere and 4 volts.

HENRY FAY, REVIEWER.

Iodometric Estimation of Tellurium. BY JAMES F. NORRIS AND HENRY FAY. *Am. Chem. J.*, **20**, 278–283.—In the presence of a large excess of alkali, tellurous acid is oxidized quantitatively by potassium permanganate to telluric acid according to the equation: (1) $2KMnO_4 + 3TeO_2 = K_2O + 2MnO_2 + 3TeO_3$. If to such a solution potassium iodide and sulphuric acid are added, the following reaction takes place: (2) $2MnO_2 + 4KI + 4H_2SO_4 = 2MnSO_4 + 2K_2SO_4 + 4H_2O + 4I$. Any excess of permanganate will react as follows: (3) $2KMnO_4 +$

$10KI + 8H_2SO_4 = 2MnSO_4 + 6K_2SO_4 + 8H_2O + 10I$. Combining equations (1) and (2) the oxidation of tellurium dioxide may be expressed in this way: $2KMnO_4 + 3TeO_2 + 4KI + 5H_2SO_4 = 3TeO_3 + 3K_2SO_4 + 2MnSO_4 + 5H_2O + 4I$. There is therefore found to be a deficit of two atoms of iodine, or two molecules of sodium thiosulphate for each molecule of tellurium dioxide present. In estimating tellurium by this method a portion of the substance, about 0.150 gram, is treated with 20 cc. of a ten per cent. solution of sodium hydroxide, potassium permanganate is added until the meniscus of the brown solution shows a deep pink. The solution is then diluted to 400 cc. with ice-water, and there are added 10 cc. of potassium iodide solution containing 2 grams of the salt, and dilute sulphuric acid until the solution becomes clear. The liberated iodine is titrated with sodium thiosulphate. The value of the permanganate solution is found in the same way by liberating iodine from potassium iodide and titrating with thiosulphate. The deficit in sodium thiosulphate represents the tellurium dioxide present. The method was tested against carefully purified tellurium dioxide made from recrystallized basic nitrate, and against the double bromide of tellurium and potassium. The process is rapid, gives accurate results, and can be used in the presence of halogen acids.

PROXIMATE ANALYSIS.

H. P. TALBOT, REVIEWER.

The Commercial Analysis of Bauxite. BY WM. B. PHILLIPS AND DAVID HANCOCK. *J. Am. Chem. Soc.*, **20**, 209–225.—In the interests of those concerned in the alum manufacture from bauxite, it is essential that a plan be devised by which the amount of easily soluble alumina may be determined, as well as the total amount. A scheme is presented by which it is possible to distinguish between the alumina present as trihydrate, that is in a state of lower hydration, and that as clay. It is suggested that the alumina soluble in sulphuric acid of 50° B. at 100° C. in one hour be called "free alumina", that soluble only when the solution is evaporated until the acid fumes appear "available alumina," while the difference would be designated as "combined alumina," this system to be adopted by producer, broker, and consumer alike.

A. H. GILL, REVIEWER.

A Comparison of Various Rapid Methods for Determining Carbon Dioxide and Monoxide. BY L. M. DENNIS. *J. Am. Chem. Soc.*, **19**, 859–870.—The results show the comparative accuracy of the various forms of apparatus in use and are summarized in the article.

The Econometer: a Gas Balance for Indicating Continuously the Proportion of Carbonic Acid Gas in the Flow of Furnace Gases. REPORT BY A COMMITTEE. *J. Franklin Inst.*, 145, 205. —Instead of absorbing the carbon dioxide, this apparatus weighs the dried and filtered gas continuously. The weight being known, the percentage of carbon dioxide is easily deduced. There are said to be over twelve hundred of these apparatus in use.

MINERALOGICAL AND GEOLOGICAL CHEMISTRY.

W. O. CROSBY, REVIEWER.

Orthoclase as Gangue Mineral in a Fissure Vein. BY WALDEMAR LINDGREN. *Am. J. Sci.*, 155, 418–420.—After noting the rather sparing occurrence of the feldspars in true veins, the author describes a silver-gold vein near Silver City, Idaho, having a gangue of quartz and orthoclase. The orthoclase is of the variety *adularia*, and the evidence of its aqueous origin is followed by an analysis yielding: SiO_2, 66.28; Al_2O_3, 17.93; K_2O, 15.12; Na_2O, 0.25; undetermined, 0.42; total, 100.00.

Notes on Rocks and Minerals from California. BY H. W. TURNER. *Am. J. Sci.*, 155, 421–428.—This paper describes: 1. A peculiar quartz-amphibole diorite, with very complete analyses of the diorite and its component amphibole; 2. A new amphibole-pyroxene rock from Mariposa County; 3. A quartz-alunite, with an analysis of the alunite, which occurs as an efflorescence; 4. Zircon from gravels; 5. Molybdenite from several localities; 6. Tellurium, selenium, and nickel in gold ores; 7. Carbonaceous material in quartz from gold veins east of the Morter Lode; 8. Berthierite from Tuolumne County.

Mineralogical Notes on Anthophyllite, Enstatite, and Beryl (Emerald) from North Carolina. BY J. H. PRATT. *Am. J. Sci.*, 155, 429–432.—The anthophyllite and enstatite are from the great dunite dikes of western North Carolina, and two analyses of each are given. The emerald is from a vein of pegmatite in Mitchell County, and was not analyzed.

The Jerome Kansas Meteorite. BY HENRY S. WASHINGTON. *Am. J. Sci.*, 155, 447–454.—This meteorite, about 65 pounds in weight, is a deeply oxidized mass made up of numerous chondrules of bronzite and olivine, with fragmental crystals of these minerals and pyroxene, and small angular masses of nickel-iron (4.3 per cent.). No troilite was recognized, but the analysis indicates that it was originally present to the extent of 5.2 per cent. An approximate chemical analysis and an analysis of the nickel-iron, which contains 10.01 per cent. of nickel, are followed by exhaustive analyses of both the soluble and insoluble portions; and from these analytic data the mineralogical composition is calculated, the chief constituents, in order of abundance, being olivine, bronzite, limonite (secondary), oligoclase, troilite, pyroxene, nickel-iron, and orthoclase.

On the Origin of the Corundum Associated with the Peridotites in North Carolina. BY J. H. PRATT. *Am. J. Sci.*, 156, 49–65.—The peridotite (dunite or olivine rock) is a basic, magnesian, plutonic rock forming lenticular dikes and bosses in gneiss, and the corundum is invariably found on the borders of these masses, between the dunite and gneiss. The author's conclusion, which appears to be well sustained by the facts, is that the corundum is not in any sense a secondary mineral, but dates from the original solidification of the dunite, having existed in the solution of the molten mass of the dunite at the time of its intrusion and separated out among the first minerals as the mass began to cool. The dunite magma holding in solution the chemical elements of the different minerals would be like a saturated liquid, and as it began to cool the minerals would crystallize out, not according to their infusibility but according to their solubility in the molten magma. The more basic portions, according to the general law of cooling and crystallizing magmas, being the most insoluble, would be the first to separate out. These would be the oxides containing no silica, such as chromite, spinel, and corundum. The important experiments of Morozewicz with molten basic glasses are cited as fully corroborating this view; and it is noted that the crystallization of the corundum and other oxides would begin on the outer border of the mass where cooling was most rapid. Convection currents would then tend to bring new supplies of material carrying alumina into this outer zone, where it would be deposited as corundum. This is essentially Becker's theory of fractional crystallization; and it is noted that the high fluidity of these very basic magmas is a very favorable condition.

Erionite, a New Zeolite. BY ARTHUR S. EAKLE. *Am. J. Sci.*, 156, 66–68.—This mineral occurs in very fine, white, pearly and woolly threads, associated with opal in a rhyolite tuff from Durkee, Oregon. Analysis gives: SiO_2, 57.16; Al_2O_3, 16.08; CaO, 3.50; MgO, 0.66; K_2O, 3.51; Na_2O, 2.47; H_2O, 17.30; total, 100.68. Allowing one molecule of water as hydroxyl, as the dehydration experiments indicate, we obtain the formula $H_2Si_6Al_2CaK_2Na_2O_{17} + 5H_2O$. This is analogous to the formula for stilbite with the calcium largely replaced by alkalies; but in other respects the new zeolite has no resemblance to stilbite.

The name refers to its woolly appearance. An analysis of the associated milky opal gave: SiO_2, 95.56; H_2O, 4.14; and a trace of alumina.

Metamorphism of Rocks and Rock Flowage. BY C. R. VAN HISE. *Am. J. Sci.*, 156, 75–91; *Bull. Geol. Soc. Am.*, 9, 269–328.—This important contribution to dynamical geology, which is condensed from a partly written treatise on metamorphism and the metamorphic rocks, is mainly a physical study; but the important cooperation of chemical agencies is fully recognized in the paragraphs on chemical action and its relations to heat and pressure, the upper and lower physico-chemical zones, etc. Van't Hoff's law, that "on the whole, the preponderating chemical reactions at lower temperatures are the combinings (associations) which take place with the development of heat, while the reactions preponderating at higher temperatures are the cleavings (dissociations) which take place with the absorption of heat, is made a basic principle of the discussion; and the contrasts of the upper and lower zones of the earth's crust resulting from this law and the natural antagonism of heat and pressure are traced out in hydration and dehydration, the mutual replacements of oxygen and sulphur, carbon dioxide and silicon dioxide, and the tendency to develop in the upper zone minerals of lower specific gravity with consequent expansion of the rocks, and in the deeper-seated zone of minerals of higher specific gravity with consequent contraction of the rocks. In both the physical and chemical categories, alike at lesser and greater depths, water is recognized as the one important and essential medium of alteration; and an almost inappreciable proportion of water is regarded as sufficient for extensive and rapid metamorphism, in which it may act solely as agent, suffering neither gain or loss. In this connection, the author cites the experiments of Barus, according to which 180° C. is a critical temperature for the solution of glass in water, the action being very slow below this temperature and astonishingly rapid above it. The solution of the glass and crystallization of its derived minerals are essentially contemporaneous and continuous processes, involving, in the absence of hydrous derivatives, no necessary diminution of the water, which may continue its work as a mineralizer indefinitely and so rapidly as to dissolve and deposit in crystalline form a volume of glass equal to that of the water in about half an hour from which the author calculates that, even if the rate for rocks be only one-thousandth that for glass, a rock formation could be dissolved and recrystallized 50,000 times by one per cent. of water in a mountain-making period of 150,000 years.

Mineralogical Notes. By C. H. Warren. *Am. J. Sci.*, 156, 116–124.—This paper describes: 1. Melanotekite, a basic silicate of iron sesquioxide and lead, from Hillsboro, New Mexico, the analyses of exceptionally pure material indicating for this species and kentrolite, the corresponding basic silicate of manganese sesquioxide and lead, the formula $Fe_4(Mn_4)Pb_3Si_3O_{15}$, instead of $Fe_2(Mn_2)Pb_2Si_2O_9$, heretofore accepted. 2. Pseudomorphs after phenacite, from Greenwood, Maine, in which gigantic crystals up to twelve inches in diameter having the form of phenacite have been completely replaced by a mixture of quartz and cookeite, with not a trace of beryllium remaining. 3. Similar pseudomorphs after large crystals of topaz from the same locality. 4. Crystallized tapiolite (tantalate of iron and manganese) from Topsham, Maine, which is distinguished by its tetragonal form from its orthorhombic dimorph, tantalite, and by its composition from the corresponding dimorphous niobates, mossite and columbite. 5. Crystallized tantalite from Paris, Maine, which is shown by its very high specific gravity (7.26) not to be columbite, while the absence of manganese adds to its chemical interest. 6. Cobaltiferous smithsonite from Boleo, Lower California, which had been mistaken for the rare hydrated cobalt carbonate, remingtonite, but which is found by analysis to contain 39.02 per cent. of ZnO and only 10.25 per cent. of CoO.

Sölvsbergite and Tinguaite from Essex County, Mass. By Henry S. Washington. *Am. J. Sci.*, 156, 176–187.—The sölvsbergite forms a dike four feet wide cutting granite, and is specially distinguished by the presence of glaucophane and riebeckite. One complete analysis is given and compared with four analyses from other regions; and from the analysis the mineral composition is computed, the chief constituents, in order of abundance, being albite, orthoclase, glaucophane, riebeckite, quartz, and titanite. In this connection an analysis is also given of the Quincy granite, in which T. G. White has reported a blue hornblende which he referred to glaucophane; analysis of four foreign granites are quoted for comparison; and the calculation of the mineral composition gives, in order of abundance, quartz, albite, orthoclase, riebeckite, and glaucophane, the riebeckite largely predominating over the glaucophane. The analyses are of special interest as pointing to the existence of a purely iron-alumina glaucophane. The tinguaite also occurs as a dike in the granite; and its most notable characteristic is the occurrence in it, apparently as an original constituent, of a large proportion (37.4 per cent.) of analcite. As before, the ana lysis is compared with the similar rocks of other regions and the mineral composition is deduced therefrom.

Distribution and Quantitative Occurrence of Vanadium and Molybdenum in Rocks of the United States. By W. F. Hillebrand. *Am. J. Sci.*, 156, 209–216.—The analytical data show the quantitative occurrence and distribution of vanadium in a large number (57) and variety of igneous rocks, in a few of the component minerals of these rocks, and in a few metamorphic and secondary rocks. Two of the samples in the last series were highly composite, one representing 253 sandstones and the other 498 limestones. The conclusions suggested by a comparison of these data are: that vanadium occurs in quite appreciable amounts in the more basic igneous and metamorphic rocks, up to 0.08 per cent. or more of V_2O_3, but seems to be absent or nearly so from the highly siliceous ones; that the chief source of the vanadium is the heavy ferric-aluminous silicates—the biotites, pyroxenes, amphiboles; that limestones and sandstones contain only very small amounts of vanadium; that molybdenum is confined to the more siliceous rocks; and so far has been found only in traces in these.

An Occurrence of Dunite in Western Massachusetts. By G. C. Martin. *Am. J. Sci.*, 156, 244–248.—The dunite or olivine rock, of which only two other occurrences are known in North America, forms an irregularly elliptical boss of distinctly igneous origin, about 1,000 by 2,000 feet in extent, in the town of Cheshire. The olivine is extensively serpentinized, and the original accessories include chromite, magnetite, and picotite. The olivine, purified by the Thoulet solution, gave on analysis: MgO, 51.41; SiO_2, 40.07; FeO, 4.84; Al_2O_3, 1.94; H_2O, 1.03; total, 99.29.

Anthracite Coal in Arizona.—By W. P. Blake. *Am. Geol.*, 21, 345–346.—This is a hard, graphitic anthracite forming heavy beds in the carboniferous strata of southern Arizona. It resembles the Rhode Island anthracite, but the percentage of ash is larger (13.20 to 30.00); it is hard to ignite, and its fuel value is practically *nil.* Five approximate analyses are given.

Studies on an Interesting Hornblende Occurring in a Hornblende Gabbro, from Pavone, near Ivrea, Piedmont, Italy. By Frank R. van Horn. *Am. Geol.*, 21, 370–374.—The approximate mineralogical composition of the gabbro is: plagioclase 33, hornblende 27, diallage and hypersthene 25, and magnetite and spinel 15 per cent. The hornblende, although one of the most basic constituents of the rock, is only occasionally approximately idiomorphic in the prismatic zone. The author suggests that this crystallographic peculiarity may be due to the high percentage of alkalies which it contains. A complete analysis is given and three others are quoted. The percentage of water is high (2.79), while the silica is very low (39.58). The discussion shows that the mineral is approximately an orthosilicate, and the author concludes that an orthosilicate molecule enters largely into the composition of the aluminous amphiboles.

Weathering of Diabase near Chatham, Virginia. BY THOMAS L. WATSON. *Am. Geol.*, **22**, 85–101.—The rock in question is a typical olivine diabase (plagioclase, augite, olivine, and magnetite) and forms great dikes intersecting both the crystalline schists and gneisses and the Triassic shales and sandstones. It weathers in concentric layers, yielding bowlder-like residual masses; and the final product is a tough clay of a bright red color, while biotite, chlorite, and serpentine are intermediate derivatives. The analytic data include: 1. Bulk analyses of fresh, partially weathered, and completely decomposed diabase, the contrast of two and three being much more marked than of one and two, and the most essential changes being greatly increased hydration, partial loss of the alkalies (the soda, as usual, suffering more than the potash), almost complete loss of the alkaline earths (the magnesia yielding more readily and completely than the lime), great increase of iron oxide due both to loss of other constituents and peroxidation of FeO, and a notable diminution of the silica due to the elimination of the protoxide bases, the alumina alone remaining essentially unchanged. 2. Analyses of the augite and feldspar, as separated by the Thoulet solution, the feldspar proving to be a labradorite whose albite-anorthite ratio is Ab_8An_9. 3. Determination of the relative amounts of material in the fresh, altered and decomposed rock soluble in hydrochloric acid of different strengths, all other conditions remaining constant. The loss was greatest in the decomposed and least in the altered material, and was limited in the former almost wholly to the iron oxide and alumina, while in the latter and the fresh rock the lime and magnesia were also largely dissolved. 4. Analyses of the portions soluble in hydrochloric acid and sodium carbonate are compared with the bulk analyses to determine the percentage of each constituent lost and retained, the total loss on passing from the fresh to the decomposed rock amounting to 70.31 per cent., although previous investigations show that this loss rarely exceeds 50 per cent. of the total rock mass. 5. A mechanical analysis of the partially decomposed rock, showing the mineralogical character of the particles of different sizes.

Chemical and Mineral Relationships in Igneous Rocks. BY JOSEPH P. IDDINGS. *J. Geol.*, **6**, 219–237.—This is an attempt to correlate the mineral composition of igneous rocks with the chemical composition of their magmas; that is, of each rock as a whole. The chief difficulties are: first, the variable composition of the rock-making minerals, quartz alone having an absolutely fixed composition and no element occurring only in one mineral; second, the fact that no fixed association of minerals necessarily results from the crystallization of a magma, the result being largely controlled by the physical conditions. To avoid undue complexity, the author confines his attention to the more important rock-making minerals, including quartz, feldspathic minerals, micas, pyroxenes, amphiboles, olivine, and magnetite. The empirical and dualistic formulas are given for each species; and the latter are classified in accordance with the ratios of the protoxide and sesquioxide bases to the silica. After quoting briefly some of the laws governing the relations of the mineral and chemical composition formulated in an earlier paper, the author discusses in greater detail and with the aid of diagrams, the relations particularly of quartz, and of leucite, nephelite and sodalite; thus making more evident the interdependence of the various minerals on one another and on the chemical composition of the magma.

A Study of Some Examples of Rock Variation. BY J. MORGAN CLEMENTS. *J. Geol.*, 6, 372–392.—The rocks in question include diorites, gabbros, norites, and peridotites occurring in the Crystal Falls iron-bearing district of Michigan. Petrographic descriptions and chemical analyses of the several types are followed by a discussion of their chemical relations, the complete analyses, percentages of the chief oxides, and atomic proportions of the metals, being presented in tabular form; and the author concludes that the rapid changes in mineralogical composition and texture in a single rock exposure, and the changes thus occasioned from one type into another through intermediate facies, show very clearly the intimate relationship of the rocks to one another, and warrants the assumption that they all belong to a geological unit.

Notes on Some Igneous, Metamorphic and Sedimentary Rocks of the Coast Ranges of California. BY H. W. TURNER. *J. Geol.*, 6, 483–499.—The rocks considered in this paper include: 1. *Metabasalts and diabases*, formerly regarded as metamorphic sandstones, of which ten analyses are quoted without discussion. 2. *Serpentine*, which has also been regarded as, in part at least, altered sedimentary rocks, but which the author holds to be, in the main at least, of igneous origin. Nine analyses, representing five localities, are quoted, showing great uniformity of composition and indicating that olivine or rhombic pyroxene must have been a prominent constituent of all of the original rocks from which the serpentines were derived. 3. *The Franciscian or Golden Gate formation.* 4. *The San Pablo formation*, which contains layers of rhyolitic tuff or pumice, of which two partial analyses are given.

Syenite-porphyry Dikes in the Northern Adirondacks. By H. P. Cushing. *Bull. Geol. Soc. Am.*, 9, 239–256.—These dikes, of which fourteen have been discovered, and which are shown by their field relations to be younger than the pre-Cambrian gneisses and anorthosites which constitute the mass of the Adirondacks and older than the Potsdam sandstone, consist of a sub-acid holocrystalline rock chiefly composed of acid feldspars (microperthite, albite, orthoclase, and microcline) and biotite, with less abundant quartz and hornblende, and accessory magnetite, hematite, apatite, and titanite, and various secondary species. Three original analyses are given, selected to represent the mean and extremes of composition; and from these the percentages of the component minerals are deduced. In the discussion of the petrologic relationships of the dikes, numerous other analyses of related rocks are quoted.

Weathering of Alnoite in Manheim, New York. By C. H. Smyth, Jr. *Bull. Geol. Soc. Am.*, 9, 257–268.—The alnoite, which forms several small dikes in the calciferous "sand rock" on East Canada Creek, is an ultrabasic type consisting largely of biotite, and serpentine derived from original olivine, the olivine itself being extremely rare, and the minor constituents are magnetite, apatite, and perofskite, with secondary calcite. The investigation is largely based upon the methods established by Merrill. Both the fresh rock and its highly weathered facies were analyzed, the chief points of interest being, as usual, the increase of ferric oxide and water and diminution of ferrous oxide, alkalies, alkaline earths and silica in the weathered material. From the analyses the loss for the whole rock and the percentages of each constituent retained and lost are calculated. The titanic oxide is shown to be one of the most resistant constituents of the rock, its behavior being almost identical with that of alumina, so that the two are taken together as the basis for comparison. The iron oxides have proved almost equally insoluble, the apparent net increase being due, of course, to peroxidation of FeO. The large proportions of magnesia and lime in the weathered rock indicate that the process is far from complete; and in harmony with this view 93.60 per cent. of the weathered rock was found to be soluble in hydrochloric acid and sodium hydrate solution. The contrast between the surface weathering and deep-seated alteration of rocks, the rate of decomposition of biotite, and the time of weathering, are also discussed. Biotite appears to weather rapidly in acid rocks and slowly in basic rocks simply because, while it is chemically one of the weakest constituents of the former, it is one of the most resistant constituents of the latter, the difference being relative only.

Clay Deposits and Clay Industry in North Carolina. BY HEINRICH RIES. *N. C. Geol. Surv., Bull. 13*, 1–157.—Although regarded as a merely preliminary report, this is a fairly comprehensive, if not a detailed account, of the clays of a great state. But it is not of local interest only, for the admirable introductory sections, forming nearly half the work, and covering the chemical and physical properties, mining and preparation of clays in general, and more specifically of the kaolins or china clays, pottery clays, fire clays, and brick clays, must prove of general interest and value. Under the chemical properties of clays are discussed: the fluxing impurities, including the alkalies, compounds of iron, lime, and magnesia; non-fluxing impurities, including silica, titanium, organic matter, and water; analytical methods; and the rational analysis of clays. The descriptive sections include nearly seventy original analyses of North Carolina clays by Prof. Chas. Baskerville, of the State University; and these are repeated in tabular form at the end of the report. Each analysis gives the silica, alumina, ferric oxide, lime, magnesia, alkalies, moisture, and water; and in certain cases the ferrous oxide, organic matter, sulphuric and titanic oxide were also determined. By way of rational analyses, on which the value of a clay chiefly depends, the clay substance (pure kaolin), free sand, and total fluxes are given in each case; and for the china clays also the percentages of quartz and feldspar in the sand.

A. H. GILL, REVIEWER.

Preliminary Paper on the Composition of California Petroleum. BY C. F. MABERY. *Am. Chem. J.*, 19, 796–804.—Oil from Ventura and Fresno counties was examined. The former is extremely heavy and dark; it has a specific gravity of 0.888 at 20°, and contains 0.84 per cent. of sulphur. On distillation it gave 9.7 per cent. below 150°, 29.1 between 150° and 300°, and 61.2 residue above 300°. It was more carefully distilled *in vacuo*. Small quantities of benzene, toluene, probably also xylene, hepta- and octo-naphthenes were obtained. These will be treated more at length in a later article.—Fresno County oil is of lighter color and lower gravity and of a greenish hue. It contains but 0.21 per cent. of sulphur. On distillation it gave 33 per cent. below 150°, 25 per cent. from 150°–200°, 21 per cent.

between 200° and 250°, 12.4 per cent. from 250° to 300°, and but 9 per cent. above 300°. It is to be further investigated.

Notes upon the Chemical Composition of Natural Gas from Great Salt Lake. By F. C. Phillips. *Proc. Eng. Soc. Western Pa.*, 13, 453.—An analysis by another observer has shown that the gas had apparently contained 16.6 per cent. of hydrogen, which would make it quite different from the gas in West Virginia. On passing the gas, however, for many hours through tubes containing pure and dry palladium chloride it was found that no hydrochloric acid was formed, which is proof that no hydrogen is contained in the gas.

[Contribution from the Massachusetts Institute of Technology.]

REVIEW OF AMERICAN CHEMICAL RESEARCH.

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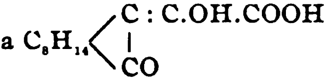
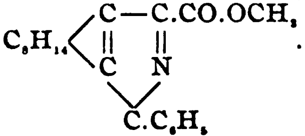
Arthur A. Noyes, Editor; Henry P. Talbot, Associate Editor.
Reviewers: Analytical Chemistry, H. P. Talbot and W. H. Walker; Biological Chemistry, A. G. Woodman; Carbohydrates, G. W. Rolfe; General Chemistry, A. A. Noyes; Geological and Mineralogical Chemistry, W. O. Crosby; Inorganic Chemistry, Henry Fay; Metallurgical Chemistry and Assaying, H. O. Hofman; Organic Chemistry, J. F. Norris; Physical Chemistry, H. M. Goodwin; Sanitary Chemistry, E. H. Richards; Technical Chemistry, A. H. Gill and F. H. Thorp.

ORGANIC CHEMISTRY.

J. F. Norris, Reviewer.

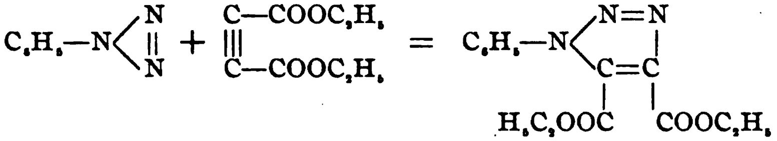
The Action of Ethylic Oxalate on Camphor (III). By J. Bishop Tingle. *Am. Chem. J.*, 20, 318-342.— In previous papers (*J. Chem. Soc.*, 57, 652, and *this Rev.*, 3, 153) the preparation of camphoroxalic acid was described, and the formation by the acid of an additive compound with hydroxylamine was given as evidence that it is an unsaturated hydroxyl derivative of the formula  $C_8H_{14}\left\langle\begin{array}{l}C:C.OH.COOH\\ \vert\\ CO\end{array}\right.$. In order to gain additional evidence for the structure of the compound, the work described below was undertaken. By the action of acetic anhydride on camphoroxalic acid three substances were obtained: One was probably the anhydride of the acid, as it was also obtained when benzoyl chloride was used instead of acetic anhydride; the second compound was a monoacetyl derivative of camphoroxalic acid; the third compound was not identified. The acetyl derivative readily combines with bromine vapor, giving an oily product, which quickly loses hydrogen bromide. When camphoroxalic acid is treated with bromine in chloroform solution, the evolution of hydrogen bromide begins immediately. The resulting oil was reduced with magnesium amalgam. The substance thus obtained closely resembled camphoroxalic acid in general properties, but an examination of the crystals showed that it was not identical with it. The compound will be studied further in order to establish its structure. When quickly distilled under ordinary pressure, camphoroxalic acid yields some camphor. Heating with barium hydroxide in a current of dry hydrogen causes almost complete conversion into camphor and oxalic acid. Attempts to convert camphoroxalic acid into an isomeric acid by prolonged heating at 150° were unsuccessful, whilst partial etherification with alcoholic hydrogen chloride failed to show any indication of non-homogeneity. When boiled with phenylhydrazine in anhydrous ether free from alcohol, the acid yields a crystalline salt. By the action of dilute sulphuric acid at 135° for three hours on camphoroxalic acid, a new acid of the formula $C_{12}H_{20}O_6$ was obtained. Ethyl camphoroxalate was obtained in pure condition by heating the acid with highly dilute absolute alcoholic hydrogen chloride. The ester readily combines with dry ammonia and with hydroxylamine. Attempts to obtain a benzoyl derivative of the ester were unsuccessful. Methyl camphoroxalate and phenyl hydrazine yield a phenylhydrazide, which is converted by glacial acetic acid into methyl camphylphenylpyrazolecarboxylate,

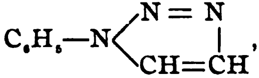


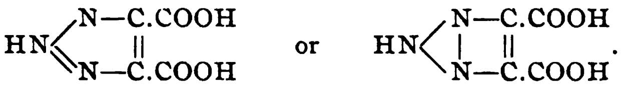
. Isoamyl camphoroxalate was also prepared and converted into a phenyl hydrazide. Camphylphenylpyrazolecarboxylic acid, when distilled over barium hydroxide, yielded an oily substance which gave Knorr's pyrazoline reaction. It probably contained camphylphenylpyrazole. Sodium camphylpyrazolecarboxylate injected into the veins of dogs is without any marked physiological action. Sodium camphoroxalate, under similar circumstances, is distinctly and rapidly toxic.

Veratrine and Some of Its Derivatives. BY GEORGE B. FRANKFORTER. *Am. Chem. J.*, **20**, 358–373.—The substance known in pharmacy as veratrine has been studied by a number of chemists, but concordant results have not been obtained, as different preparations of the alkaloid differ widely in composition and chemical, physical, and physiological properties. The author finds that crystallized veratrine is identical with the cevadine of Bossetti (*Arch. Pharm.*, *1883*, 82). The name veratrine, however, has been retained since cevadine is the common veratrum alkaloid used at present, and it seems advisable to retain the name which associates the alkaloid with the genus of plants from which it is obtained. The substance investigated was the so-called "Merck veratrine." The free alkaloid has the composition $C_{32}H_{49}NO_9.H_2O$ and was shown to contain a methoxy group. By triturating veratrine with a large excess of iodine, an iodide containing four atoms of iodine and three molecules of water of crystallization was obtained. When this salt was heated at 110° to constant weight, an iodide containing two atoms of the halogen resulted. With ammonia the tetraiodide gave a monoiodide. Chloral hydrate reacted readily with the alkaloid forming a compound of the composition $CCl_3CH(O.C_{32}H_{48}NO_8)_2$. With methyl iodide an addition-product is formed. The iodine in this compound was removed by means of silver oxide and the resulting hydroxyl compound, $C_{32}H_{49}NO_9.CH_3OH$, converted into a hydrochloride, which formed a double salt with gold chloride. The alkaloid also formed crystalline addition-products with ethyl bromide and allyl iodide.

On the Formation of Imido-1,2-Diazol Derivatives from Aromatic Azimides and Esters of Acetylenecarboxylic Acids. By A. MICHAEL, F. LUEHN, and H. H. HIGBEE. *Am. Chem. J.*, **20**, 377–395.—Phenylazimide readily unites with the esters of $\Delta\alpha\beta$-acids of the acetylene series. The resulting addition-products do not show the instability that characterizes the trinitrogen ring, but are stable towards heat and towards most reagents. Phenylazimide and acetylenedicarboxylic ester reacted according to the following equation :



The resulting *n*-phenylimido-1,2-diazoldicarboxylic ester was converted into the free acid, and a number of its salts were prepared. When the acid was heated *n*-phenyl-1,2-imidodiazol, , a weakly basic substance which formed a platinum double salt, was obtained. In order to establish the above formula for the diazoldicarboxylic acid, it was transformed into the triazolcarboxylic acid, which was prepared by Bladin (*Ber. d. chem. Ges.*, **26**, 545) and which has the formula



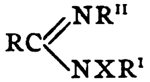
As direct oxidation did not remove the phenyl group from *n*-phenylimido-1,2-diazoldicarboxylic acid a nitro group was introduced and then reduced. The amino acid thus formed was readily oxidized to the above triazoldicarboxylic acid. The nitro derivative was prepared by condensing nitrophenylazimide with acetylenedicarboxylic ester, because a small yield of it was obtained when the diazoldicarboxylic acid was nitrated. *p*-Nitro-*n*-phenyl-1,2-imidodiazol was obtained by heating the corresponding dicarboxylic acid. Phenylazimide condenses with phenylpropiolic ester and forms *n*-phenylimidophenyl-1,2-diazolcarboxylic acid. The compounds mentioned and a number of their derivatives are described in detail. The conclusion can be drawn from the authors' work that the addition of substituted azimides to esters of the acetylene carboxylic acids to form imidodiazol derivatives is a general reaction, since the fatty monobasic acetylene acids add negative atoms more readily than phenyl propiolic acid.

On the Oxide of Dichlormethoxyquinonedibenzoylmethylacetal. By C. Loring Jackson and H. A. Torrey. *Am. Chem. J.*, **20**, 395–430.—The substance prepared by Jackson and Grindley (*Am. Chem. J.*, 17, 644) by the action of sulphuric acid on dichlordimethoxyquinonedibenzoyldimethylacetal has been found to be the oxide of dichlormethoxyquinonedibenzoylmethylacetal. It is the first example of an orthoquinone and has the following structure: $C_6.OCOC_6H_5(1),Cl(2),OCH_3(3),$-$OCOC_6H_5(4),OCH_3(4),Cl(5),O(6,1)$. The fact that the compound is not a ketone was shown by the failure of hydroxylamine to react with it, and by the formation of the sodium salt of chloranilic acid with a hot solution of sodium hydroxide. The substance does not contain a hydroxyl group since it is inactive with cold sodium hydroxide. Isoamylamine converts the oxide into the isoamylamine salt of oxydichlorisoamylamidoquinone, and sodium methylate changes the oxide into the sodium salt of dichlordimethoxyquinonedimethylhemiacetal. It is shown that these facts are evidence against the oxide being a paraquinone. The above reaction can be explained, however, if the substance is either an ortho- or a metaquinone, but the analogy between the reactions of ethylene oxide and those of the compound under discussion are so striking, that it is probable that the ortho structure exists in the oxide. Since a decision between the ortho and meta formulæ could not be founded on any study of the derivatives of the oxide, as both bodies give the same products when the oxygen bond was opened, the action of boiling sulphuric acid on pyrocatechin and resorcin, substances containing two hydroxyl groups in the ortho and meta positions, respectively, was studied. Resorcin gave resorcin ether and pyrocatechin gave colored products which were probably formed from a quinone. These experiments, therefore, did not furnish evidence for either structure. The compound formed by the action of isoamylamine on the oxide was shown to be the salt of the amine and a phenol of the composition $C_6Cl_2(C_5H_{11}NH)HOO_2$. For the sake of comparison with this body, dichlordiisoamylamidoquinone was made by the action of isoamylamine on chloranil. This compound, as well as the isoamylamine salt of chloranilic acid, differed entirely in properties from the product made from the oxide. Tetrabromguaiacol and tribromveratrol, which were made in connection with the work on the action of sulphuric acid on pyrocatechin derivatives, are described. The following acetyl acetals were prepared: $C_6Cl_2(OCH_3)_2(OCH_3)_2(OCOCH_3)_2$ and $C_6Cl_2(OC_2H_5)_2(OC_2H_5)_2(OCOCH_3)_2$. Some experiments on the action of sodium alcoholates on quinone and chloranil, which led to the formation of very unstable colored compounds, are described. It is shown that an alkaline solution of sodium chloranilate is converted into iodoform by treatment with iodine.

On the Colored Compounds Obtained from Sodic Alcoholates and Picryl Chloride. BY C. LORING JACKSON AND W. F. BOOS. *Am. Chem. J.*, 20, 444–454.—The authors have continued the work of Jackson and Ittner (*this Rev.*, 3, 107) on the colored products of the action of sodium alcoholates on certain aromatic nitro compounds. The substances formed from picryl chloride and the sodium derivatives of methyl, ethyl, propyl, isoamyl, and benzyl alcohol have been studied. They all have the formula $C_6H_2(NO_2)_3ORNaOR$, and are decomposed by acids giving picric ethers. According to the theory of Victor Meyer, these compounds are formed by the replacement of a hydrogen atom in the benzene ring by sodium, and the addition of a molecule of alcohol of crystallization. The fact, established by the authors, that the methyl compound can be heated to 130° without loss of weight, is evidence against the above theory. The more probable view is that the compounds are formed by the addition of the alcoholate to the picryl ether. Whether the alcoholate is added to the carbon of the benzene ring, or to a nitro group, is still an open question. By the decomposition of the corresponding colored compound with an acid, propyl, isoamyl, and benzyl ethers of picric acid were prepared. When a concentrated solution of picryl chloride in methyl alcohol was treated with an excess of an aqueous solution of barium hydroxide, a compound of the following formula was precipitated: $[C_6H_2(NO_2)_3OCH_3]_2Ba(OH)_2.10H_2O$.

On the Action of Orthodiazobenzenesulphonic Acid on Methyl and Ethyl Alcohol. BY E. C. FRANKLIN. *Am. Chem. J.*, 20, 455–466.—A detailed description of the preparation of *o*- and *m*-amidobenzenesulphonic acids from benzene is given, together with an account of the separation and purification of the acids. *o*-Diazobenzenesulphonic acid was decomposed with methyl alcohol at atmospheric pressure, at an increase of 850 mm., and at a decrease of 450 mm. of mercury: The methoxy product alone was obtained. With ethyl alcohol only the alkoxy reaction took place, although the yield was less than when methyl alcohol was used. Increased pressure favors the reaction. When *p*-methoxy or *p*-ethoxybenzenesulphonamide was treated with fuming nitric acid, *m*-dinitrobenzene and a nitro substitution-product of the corresponding sulphonic acid were formed. *o*-Methoxybenzenesulphonamide and fuming nitric acid gave, as one of the reaction-products, *m*-dinitrobenzene. With the meta compound, however, no dinitrobenzene was formed.

The Action of Nitric Acid on Tribromacetanilide. By William B. Bentley. *Am. Chem. J.*, 20, 472–481.—On account of the conflict between the description of the nitro derivative of *s*-tribromaniline published by Körner (*Jsb. d. Chem.*, *1875*, 347) and that given by Remmers (*Ber. d. chem. Ges.*, 17, 266) the author undertook a study of the compound. According to Remmers, tribromnitraniline can be prepared by saponifying with ammonia the nitro compound formed by the action of nitric acid on tribromacetanilide. The author was unable to obtain a nitro derivative from tribromacetanilide. Fuming nitric acid either had no action or produced an oily mass, from which nothing crystalline could be obtained. With concentrated acid (sp. gr. 1.38) several products were formed—tetrabrombenzene, a volatile oil of irritating odor (probably dibromdinitromethane), bromanil, oxalic acid, and picric acid. If the nitric acid was dilute, or was used in glacial acetic acid solution, the products were the same as when concentrated acid was used. In attempting to establish the identity of the bromanil formed in the reaction, the action of sodium phenylate on it was studied. In absolute alcohol solution dibromdiethoxyquinone was formed, but if 95 per cent. alcohol was used dibromdiphenoxyquinone was obtained as described by Jackson and Grindley (*this Rev.*, 1, 427).

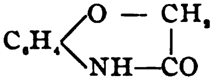
Researches on the Cycloamidines: Pyrimidine Derivatives. By H. L. Wheeler. *Am. Chem. J.*, 20, 481–490.—For convenience of reference the author calls cycloamidines those compounds which have the amidine formation  $RC\begin{matrix} /\!\!/ NR^{II} \\ \diagdown NXR^{I} \end{matrix}$ in which two of the radicals R, R^{I}, and R^{II} are replaced by a ring structure or a bivalent grouping. There are two types of cycloamidines, each type having a tautomeric form. The first contains one nitrogen atom in the ring; the second contains two. The object of the work, of which the present paper gives a preliminary account, was to compare the action of alkyl halides on cycloamidines and on simple amidines, in order to get further evidence of the correct structure of these compounds. According to Peckmann (*Ber. d. chem. Ges.*, **28**, 2362 and 869) when a simple amidine reacts with alkyl iodides, the hydrogen X is directly replaced, and hence the reaction serves to determine the structure of the compound. It is the author's opinion, however, that the above reaction is not conclusive evidence, for the alkyl iodides may be added either to the amido or imido group, or, when the substituents are similar, to both, and also perhaps to the atoms joined by the double bond. As a confirmation of the above opinion the author finds that phenylmethylanilidopyrimidine acts with methyl and ethyl iodides forming stable addition-products, and that no substitution takes place. As these compounds yield alcohols, sodium iodide, and unaltered anilidopyrimidine quantitatively when treated with alkali, the alkyl iodide in all probability was joined to one of the tertiary nitrogen atoms. From analogy a similar structure might be expected in the case of the alkyl halogen addition-products of the simple amidines. If this is the case the structure of the latter compounds must be completely revised, and the tautomeric structure must be assigned to them. Phenylmethylpyrimidon, a cycloamidine of the second type, unites with one molecule of methyl iodide to form a compound, which is decomposed into hydrogen iodide and an alkylated pyrimidon when treated with alkali. The alkyl derivative differs from the product obtained by heating phenylmethylchlorpyrimidine with sodium methylate. The alkyl iodide, therefore, is added to one of the nitrogen atoms of the pyrimidon ring.

On Phenylglutaric Acid and Its Derivatives. BY A. S. AVERY AND ROSA BOUTON. *Am. Chem. J.*, **20**, 509–515.—By the condensation of benzalmalonic ester with sodium malonic ester an oil was formed which could not be purified, but which consisted principally of benzaldimalonic ester, as it yielded β-phenylglutaric acid when saponified with hydrobromic acid. The silver, copper, and barium salts and the anhydride of the acid were analyzed. From the anhydride β-phenylglutaranilic acid, β-phenylglutaranil, and β-phenylglutar-*p*-tolilic acid were prepared. By the action of fuming sulphuric acid on the anhydride an acid containing no sulphur was obtained. Its nature was not established.

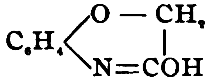
On α-Methyl-β-phenylglutaric Acid. BY A. S. AVERY AND MARY L. FOSSLER. *Am. Chem. J.*, **20**, 516–518.—α-Methyl-β-phenylglutaric acid was prepared by the following method: The methyl ester of α-methylcinnamic acid was condensed with sodium malonic ester. When acidified the condensation-product yielded methylphenylpropanetricarboxylic ester, and, on saponification with potassium hydroxide, the corresponding acid. The impure acid, when distilled over a free flame, gave the anhydride of α-methyl-β-phenylglutaric acid. The latter was dissolved in ammonia, treated with copper sulphate, and the free acid obtained by decomposing the copper salt with hydrogen sulphide. The silver salt was analyzed. As the acid contains two asymmetric carbon atoms the authors propose to study it further.

Researches on the Cyclo Amides: α-Ketobenzmorpholine and α-Benzparaoxazine Derivatives. BY H. L. WHEELER AND BAYARD BARNES. *Am. Chem. J.*, **20**, 555–568.—α-Ketobenzmorpholine has the structure of a cyclo amide and yields isomeric compounds derived from the following tautomeric formulæ:

(1)

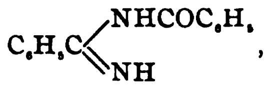


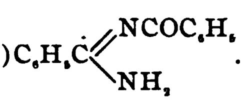
(2)

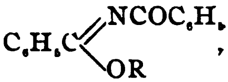


From the sodium and silver salt of the cyclo amide and alkyl iodides, derivatives of formula (1) and formula (2) (oxybenzparaoxazine), respectively, were obtained. The structures of the alkyl substitution-products were determined by the following facts: The product obtained by the action of methyl iodide on the sodium salt gave on prolonged heating with concentrated hydrochloric acid, at a high temperature, *o*-methylaminophenol, thus showing in the case of the sodium salts that the alkyl groups attach themselves to nitrogen. The products obtained from the silver salts immediately regenerated α-ketobenzmorpholine with cold dilute hydrochloric acid. This instability in the presence of acids, being a characteristic property of substituted imido esters, shows that in this case the alkyl groups are attached to oxygen. This analogy between the salts of α-ketobenzmorpholine and the salts of the anilides was shown further by the physical and chemical properties of the compounds. The cycloimido esters obtained from the silver salt have marked odors and decompose into ketobenzmorpholine on exposure to the air; the isomeric compounds have no odor and are stable on exposure. The compounds from the silver salt react with bases giving amidines, which yield well-crystallized salts. The silver salt of the cycloamide reacts with acyl chlorides, like the silver salts of the anilides, giving characteristic derivatives which have the acyl group joined to nitrogen. It follows that α-ketobenzmorpholine behaves like formanilide, and, therefore, has the structure represented by formula (1). The authors are of the opinion that amides have the keto formula because their oxy compounds do not lose water and form lactones. If the amides had the enol structure they would be imido acids and their oxy derivatives would be expected to separate water like the oxy acids. The following substances are described: The sodium, methyl, and ethyl derivatives of α-ketobenzmorpholine; the silver, methyl, ethyl, isopropyl, isobutyl, and isoamyl derivatives of oxybenzparaoxazine; the acetyl, benzoyl, phenylamino, *m*-chlorphenylamino, β-naphthylamino, isobutylamino, and allylamino derivatives of benzparaoxazine; and a number of the salts of the amino derivatives.

The Action of Amines on Acylimidoesters: Acyl Amidines. By H. L. Wheeler and P. T. Walden. *Am. Chem. J.*, 20, 568–576.—On account of the ease with which benzoylbenzamidine separates ammonia, giving dibenzamide, Pinner (*Die Imidoäther und ihre Derivate*) assigns to the compound the structure represented by formula (1):

(1) 
$$\mathrm{C_6H_5C}\left\langle\begin{array}{l}\mathrm{NHCOC_6H_5}\\ \mathrm{NH}\end{array}\right.,$$

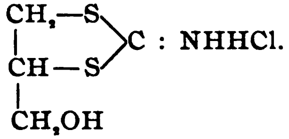
(2) 
$$\mathrm{C_6H_5C}\left\langle\begin{array}{l}\mathrm{NCOC_6H_5}\\ \mathrm{NH_2}\end{array}\right..$$

The authors find that benzoylbenzimido esters,  $\mathrm{C_6H_5C}\left\langle\begin{array}{l}\mathrm{NCOC_6H_5}\\ \mathrm{OR}\end{array}\right.$, react with ammonia, giving a compound which was shown to be identical with that obtained by Pinner, while an isomeric compound, formula (2), would be expected if the reaction takes place, as is usually assumed, by double decomposition, replacement, or substitution. It is probable that the action of amines on acylimidoesters, like the action of amines on the amidines themselves, does not take place by direct replacement, but involves the intermediate formation of an unstable addition-product, which in breaking down could form a compound of a type represented by either of the above formulas. That this view is correct and that this decomposition has no significance in regard to the structure of the acyl amidines is shown by the behavior of the analogously constituted acylimido esters, benzoylbenzimidoethyl ester, and benzoylphenylacetimidoethyl ester. These compounds easily decompose with water: The first gives dibenzamide and alcohol, and the second benzamide and ethylphenyl acetate. The structure of amidines cannot, therefore, be determined by their decomposition-products. A number of acyl amidines are described. They are stable towards cold alkali. Some of them dissolve in acids and can be precipitated unchanged by alkali or ammonia. They combine with one equivalent of hydrogen chloride to form unstable salts. In aqueous solutions these salts decompose, forming a diacylamide.

Preparation of Sodium Benzenesulphonate. By H. W. Hochstetter. *J. Am. Chem. Soc.*, 20, 549.—If, in the preparation of sodium benzenesulphonate by the method of Gattermann (*Die Praxis des organischen Chemikers*) the sulphonic acid is added to a sodium chloride solution having a specific gravity of 1.151 at 18°, the resulting salt is obtained in an almost pure condition. When a saturated salt solution is used the sulphonate is contaminated with about thirty-seven per cent. of sodium chloride.

The Action of Organic Acids upon Nitrils. BY JOHN ALEXANDER MATHEWS. *J. Am. Chem. Soc.*, **20**, 648–668.—The author summarizes his work briefly as follows: (1) Cyanacetic acid under certain conditions appears to rearrange to yield its isomer malonimide. (2) Benzoic acid and ethylene cyanide give benzonitrile and succinimide. (3) Phenylacetic acid and ethylene cyanide give phenylacetonitrile and succinimide. As a secondary product phenylacetic acid and phenylacetonitrile give diphenyldiacetamide. (4) In (2) and (3) it seems probable that β-cyanpropionic acid is an intermediate product and rearranges to give succinimide, and that in general, when an imide is produced by this reaction, it may be considered as resulting from an intermediate cyan acid. (5) The substituted monobasic acids, salicylic and anthranilic, give no similar results on account of the decomposition they undergo by heating. (6) Phthalimide results from phthalic acid and propionitrile, and phthalimide and succinimide result from phthalic acid and ethylene cyanide. (7) Phthalic anhydride and acetonitrile do not react under the conditions presented. (8) Terephthalic acid and propionitrile do not react under the conditions presented. (9) Homophthalimide is not readily formed from homophthalic acid and a nitrile. It does not result by a rearrangement of cyan-*o*-toluic acid. (10) Diphenimide results in nearly theoretical amounts from diphenic acid and acetonitrile. (11) *o*-Sulphobenzoic acid and acetonitrile yield a compound isomeric with saccharin which may be unsymmetrical *o*-sulphobenzimide. (12) By varying the conditions three of the four possible imides of mellitic acid were produced by heating this acid with acetonitrile. The *p*-euchronic acid is a new compound; *o*-euchronic acid and paramid were already known. It has been shown that aluminum amalgam can be used to give the euchron test.

The Action of Metallic Thiocyanates upon Aliphatic Chlorhydrins. BY WILBER DWIGHT ENGLE. *J. Am. Chem. Soc.*, **20**, 668–678.—The author's results may be briefly summarized as follows: Monochlorhydrin, α,γ-dichlorhydrin, and acetodichlorhydrin form corresponding thiocyanates, which are very unstable and immediately change to complex secondary compounds. α,β-dibromhydrin and its acetic ester form dithiocyanates, which can be separated and purified. Treated with tin and hydrochloric acid they give double chlorides of tin and a compound of the probable structure



Epichlorhydrin readily forms epithiocyanhydrin, which gives epihydrin sulphide with hydrogen sulphide, and epihydrindimethylsulphine iodide with ethyl iodide.

Acetonechloroform. By Frank K. Cameron and H. A. Holly. *J. phys. Chem.*, 2, 322–335.—From the products of the reaction between acetone and chloroform in the presence of potassium hydroxide Willgerodt (*Ber. d. chem. Ges.*, 14, 2456) isolated two substances which had the same composition and chemical properties. These were called solid and liquid acetonechloroform and were assigned the following formulæ respectively: $(CH_3)_2C.CCl_3.OH$ and $(CH_3)_2C.CCl_2H.OCl$. The authors have studied these compounds and have come to the conclusion that the liquid variety consists of the solid contaminated by a small amount of acetone and water. When the pure solid compound was moistened and distilled, an oil was formed which had all the properties of the liquid described by Willgerodt. Molecular weight determinations of the pure solid made by the freezing-point and boiling-point methods, using benzene and acetone as solvents, gave results agreeing with a simple molecular formula. From a study of the changes produced in the freezing-point of acetonechloroform by the addition of varying quantities of water, the conclusion is drawn that the hydrate previously described does not exist. Since the added water cannot be removed mechanically the mixture is perhaps a case of a solid solution.

The Menthol Group. By Edward Kremers. *Pharm. Arch.*, 1, 107–121.—A critical review of the methods of preparation and properties of menthene and its nitrosochloride is given. Molecular weight determinations of the nitrosochloride were made, using ether, benzene, and chloroform as solvents. The results varied from 278 to 982, and were found to be dependent on concentration and temperature. Menthene nitrosate was shown to have twice the molecular weight represented by its formula.

Decomposition of Iodoform by Light. By Edward Kremers and E. C. W. Koske. *Pharm. Arch.*, 1, 194–200.—According to Fleury (*J. de Pharm. et de Chem.* [6], 6, 97), when light acts upon a solution of iodoform, iodine is set free until the brown color in the solution prevents further decomposition. In one experiment when silver was added to unite with the liberated iodine the decomposition was complete. The authors show that iodoform is decomposed slowly by light which has passed through a solution of iodine in potassium iodide, and that nearly all of the iodine in iodoform is removed by silver in the dark after standing seven days.

ANALYTICAL CHEMISTRY.

PROXIMATE ANALYSIS.

A. H. GILL, REVIEWER.

On the Occurrence of Hydrogen Sulphide in the Natural Gas of Point Abino, Canada; and a Method for the Determination of Sulphur in Gas Mixtures. BY F. C. PHILLIPS. *J. Am. Chem. Soc.*, 20, 696–705.—The gas mentioned in the title contained about 0.8 per cent. by volume of sulphuretted hydrogen. To determine sulphur in gas mixtures the gas is burned with oxygen from a burner resembling a Bunsen blowpipe, surrounded by a cylinder arranged so that the products of combustion can be collected in sodium hypobromite solution, the sulphur being finally estimated as sulphate. Where small samples of gas are collected these are displaced by the use of carbonic oxide. The results obtained by the precipitation of lead sulphide agreed very well with those obtained by combustion.

The Chemical Composition and Technical Analysis of Water Gas. BY E. H. EARNSHAW. *Am. Gas. Light J.*, 69, 488–490; 528–529.—Benzene is absorbed by alcohol saturated with gas over mercury, the alcohol vapor being afterwards absorbed by water; carbon dioxide, by potassium hydrate; illuminants, by a saturated solution of bromine water; oxygen, by phosphorus; and carbonic oxide, by cuprous chloride, using finally a fresh pipette. The determination of hydrogen and the remaining hydrocarbons is effected by exploding a part of the residue over mercury, and by burning another part with air by passing over palladium black, the object of this being to determine the amount of CO left unabsorbed by the cuprous chloride, amounting sometimes to 0.4 per cent. The method of calculation of the results of explosion giving the average composition of the illuminants and the higher marsh gas hydrocarbons, as well as the calculation of the heating value, are also detailed.

The Determination of Methane, Carbon Monoxide, and Hydrogen by Explosion in Technical Gas Analysis. BY W. A. NOYES AND J. W. SHEPHERD. *J. Am. Chem. Soc.*, 20, 343.—The apparatus used was that of Orsat, a fourth pipette being added for explosions; water acidulated with sulphuric acid was used as the confining liquid, it lessening the absorption of carbon dioxide. The results obtained are fairly satisfactory for technical work, those for methane varying from 0.5 per cent. too high to 0.2 too low, for carbonic oxide from 1.9 to 0.3 too low, for hydrogen from 0.3 too high to 0.5 too low.

The Gas Composimeter. *Elec. Eng.*, 25, 311.—The article which is illustrated describes an instrument for determining and recording the per cent. of carbon dioxide in chimney gases. It depends for its action upon the flow of gases through small apertures. Gas is sucked constantly out of the chimney, passed through potassium hydrate solution, and the difference in the rate of flow of the residue and of the original gas is noted.

A. G. WOODMAN, REVIEWER.

Standards for White and Black Mustard Seed. BY JOHN URI LLOYD. *Pharm. Rev.*, 16, 328–333.—This work was undertaken with a view to establish a standard for starch in powdered black and white mustard seed. The author finds for black mustard seed that the presence of even 0.1 per cent. of starch is shown by iodine in the presence of potassium iodide. He recommends that this test be employed after the sample has been mixed with a definite quantity of seed previously ascertained to be free from starch. For white mustard seed it was found that by the above test as little as 0.05 per cent. of starch can be detected with certainty.

Report on an Investigation of Analytical Methods for Distinguishing between the Nitrogen of Proteids and that of the Simpler Amides or Amido Acids. BY J. W. MALLET. *U. S. Dept. Agr., Div. Chem., Bull.* 54, 1–25.—This report embodies the results of an investigation undertaken by the author at the suggestion of the Office of Experiment Stations. A study was made of a number of typical substances representing proteids, gelatinoids, and the simpler amides and allied substances. An attempt to separate the water-soluble proteids from the amides by Graham's method of dialysis gave fairly clean separations of leucin, aspartic acid, and kreatin from solutions containing albumen, but the process was found inconveniently slow. The reaction with nitrous acid and evolution of elementary nitrogen gave results which varied greatly and no differences were found upon which an analytical procedure could be based. Experiments on the interaction with sodium hypobromite, and with potassium permanganate in the presence of free acid or alkali, also gave no indication of distinctions sufficient for use in analysis. The only reagent that was found to give satisfactory results was a solution of phosphoduodeci-tungstic acid in dilute hydrochloric acid. By the use of this reagent as a precipitant, followed by thorough washing of the precipitate with hot water, it was found possible to effect a separation of the simpler amidic substances from all the proteids and proteid-like bodies except the peptones. This last group can be precipitated, however, by tannic acid. Full details of the proposed method are given. In order to calculate from the nitrogen found in each group after separation the amount of the proximate nitrogenous constituent present, the following factors are suggested: for proteids and allied substances, 6.25; for flesh bases and simpler amids of animal origin, 3.05; for simpler amids and amido acids of vegetable origin, 5.15; and for mixed amidic constituents of unabsorbed residua in digestion experiments, 9.45.

Separation of Proteid Bodies from the Flesh Bases by Means of Chlorin and Bromin. By H. W. Wiley. *U. S. Dept. Agr., Div. Chem., Bull.* **54**, 27–30.—This article is a description of the method of separation proposed by Rideal and Stewart and used in the laboratory of the Agricultural Department. After the finely ground material has been extracted with ether to remove fat, it is thoroughly exhausted with cold or lukewarm water, and then with water nearly boiling. The water-soluble constituents of the nitrogenous constituents, which have been thus extracted, are then precipitated by agitation with bromine water. The sum of the nitrogen in the part insoluble in water and in the part precipitated by bromine is subtracted from the total nitrogen determined in the original sample, and the difference is the nitrogen in the flesh bases. The proteids are calculated by the factor N × 6.25, and the flesh bases by the factor N × 3.12.

Commercial Fertilizers. *Md. Agr. Coll. Quart.*, **1**, 1–41; *Ky. Agr. Expt. Sta. Bull.*, **76**, 97–105.

ASSAYING.

H. O. Hofman, Reviewer.

The Taylor Improved Assay Furnace. By R. P. Rothwell. *Eng. Min. J.*, **65**, 583.—This is a portable sheet-iron muffle-furnace weighing 250 pounds. It is 12 inches square, is lined with 2-inch fire-brick, takes a 6x12x4-inch muffle, and can be used as a melting furnace for a No. 16 graphite crucible after removing the muffle.

An Improved Method for Preparing Proof Gold and Silver. By J. W. Pack. *Eng. Min. J.*, **66**, 36.—The improvement on the ordinary methods consists in precipitating gold and silver on aluminum foil. From a dilute solution of auric chloride, poured into a beaker containing aluminum foil, the gold is at once precipitated quantitatively; argentic chloride is completely decomposed by aluminum. Any residual aluminum is removed by warming the precipitated silver with hydrochloric acid.

APPARATUS.

A. H. Gill, Reviewer.

A Convenient Gas Generator and Device for Dissolving Solids. By T. W. Richards. *Am. Chem. J.*, **20**, 189–195.—Six different forms of apparatus are figured and explained. They are simply constructed, give a constant evolution of gas, and the acid employed is completely used up; furthermore, the waste acid can be withdrawn without interrupting the action of the generator.

An Efficient Gas Pressure Regulator. By Paul Murrill. *J. Am. Chem. Soc.*, **20**, 801.—The apparatus is of the usual floating bell type, and would seem to be very efficient and cheap.

Electric Furnaces for the 110-Volt Circuit. By N. M. Hopkins. *J. Am. Chem. Soc.*, **20**, 769–773.

Volumetric Apparatus. By G. E. Barton. *J. Am. Chem. Soc.*, **20**, 731–739.—The article compares the capacities of liter flasks standardized at various temperatures and advocates 22° C. as a standard as being more nearly that of the laboratory. The error of graduation of ten liter flasks from domestic and foreign makers was found to vary from zero to three hundredths of one per cent; the probable error in checking the calibration of a liter flask was ascertained to be not more than six-thousandths of one per cent. It was determined further that a difference in temperature of 0.1°, or a change of 15 mm. in the barometer, produced a variation of 0.02 cc.

Lubricants for Glass Stop-cocks. By F. C. Phillips. *J. Am. Chem. Soc.*, **20**, 678–681.—Two mixtures, one of 70 parts pure rubber, 25 parts spermaceti, and 5 parts vaseline, the other of 70 parts rubber and 30 parts unbleached beeswax, were found to yield the best results. The rubber should be new and pure and be melted at a low temperature in a covered vessel and the wax added and the mixture thoroughly stirred. The lubricant is unsaponifiable, but may be removed from the apparatus by nitric acid.

On a New Form of Water Blast. By B. B. Boltwood. *Am. Chem. J.*, 20, 577–580.—The apparatus cannot be well understood without the diagram; the orifice offered for the entrance of air and water is of such size that any appreciable friction is avoided and the energy of the jet is transmitted to a much greater volume of water than in the Richards or Muencke apparatus. These latter forms furnish only 1.1 times the quantity of air for water used; this apparatus gives three times the volume of air for water employed.

TECHNICAL CHEMISTRY.

G. W. Rolfe, Reviewer.

The Clarification of Cane Juice with Lime, Sulphur, and Heat. By R. E. Blouin. *La. Planter and Sugar Mfr.*, 20, 375–379.—An important paper on clarification of cane juice. The author's conclusions which favor preliminary sulphuring of the cold juice, liming to neutrality, and subsequent heating as the most effective means of clarification, are borne out by the elaborate analytical data presented.

The Use of Lime and Sulphur in Sugar House Work. By E. W. Deming. *La. Planter and Sugar Mfr.*, 20, 379–381.—This paper contains many useful hints and notes on the application of these clarifying agents in factory practice.

Double Sulphuration and Filtration. By A. L. Barthol-emy. *La. Planter and Sugar Mfr.*, 21, 28–29.—The author discusses the merits of the system.

Centrifugal Defecation and Carbonatation. *Sugar Beet*, 19, 79–80. This article describes the Hignette method of cold defecation of beet-juice with lime and separation of the precipitate from carbonatation by centrifugals. The advantages claimed are decrease of bulk of scums and consequent saving of sugar, amounting to 20 cents a ton.

BIOLOGICAL CHEMISTRY.

A. G. Woodman, Reviewer.

Analysis of the Rhizome of Aralia Californica. By William R. Monroe. *Am. J. Pharm.*, 70, 489–492.—The author has made a study of the rhizome in a fresh condition and has separated a volatile oil having a strong aromatic odor. Besides minute quantities of sugars and proteid matter he found considerable amounts of calcium oxalate.

The Chemical Life History of Lucern. By John A. Widtsoe and John Stewart. *Utah Agr. Expt. Sta. Bull.*, 58, 1–90.—This bulletin contains the results of a study of the chemical composition of lucern at different periods of its growth. The method of analysis has been mainly that of Dragendorff, the various extracts obtained having been subjected to a detailed examination. Experiments have also been made on the digestibility of lucern by methods of natural digestion.

Condensing Milk by Cold Process. By Byron F. McIntyre. *Sci. Am. Supp.*, 56, 18976–18977.—In condensing milk by cold process it is found necessary to have milk free from animal odor, because any odor is intensified by the condensation. The flavor is therefore corrected if necessary by heating the milk to 80° F. in a vacuum pan. It is then run through a separator set for "heavy cream" (assaying not less than 50 per cent. fat). The fat-free milk is cooled and then placed in freezing closets for twenty-four hours, the ice being removed at intervals by the centrifugal machine. 100 gallons of milk are condensed to 13 gallons, then 5½ gallons of the heavy cream are added, so that if the final product is diluted with three times its volume of water it will contain an average of 3.6 per cent. of fat. The condensed milk has a sp. gr. of about 1.16; it has a smooth consistency, and a pronounced sweet taste. In keeping qualities it is superior to whole milk.

The Amount of Formaldehyde Gas Yielded by Different Lamps and Generators. By E. A. de Schweinitz. *J. Am. Pub. Health Assoc.*, 23, 118–120.—The author finds that the various generators which he has examined do not furnish the theoretical or guaranteed amount of gas, the amount obtained varying from 2½ per cent. to 20 per cent. of the guaranteed yield. The method found most satisfactory for the determination of the formaldehyde was the one depending upon the decomposition of hydroxylamine hydrochloride by formaldehyde gas. The formaldehyde acts upon the hydroxylamine hydrochloride so that hydrochloric acid is quantitatively replaced, according to the following formula: $NH_2O + HCl + HCHO = CH_2{>}N{-}OH + HCl + H_2O$. The hydrochloric acid set free was determined by titration with tenth-normal alkali.

Report of the Committee on Disinfectants. By Franklin C. Robinson. *J. Am. Pub. Health Assoc.*, 23, 101–109.—This preliminary report contains a description of the modes of preparation, and of the chemical properties of formaldehyde, together with suggestions as to its use for disinfection.

On the Determination of Undigested Fat and Casein in Infant Feces. By Herman Poole. *J. Am. Chem. Soc.*, 20, 765–769.—This paper is a continuation of one already published (*this Rev.*, 4, 115). Results are given of a study of three cases in which the children were fed on a milk prepared from the average milk of a large number of cows, care being taken to have the milk, as nearly as possible, of the same composition.

The Fertilizing Value of Street Sweepings. By Ervin E. Ewell. *U. S. Dept. Agr., Div. Chem.*, *Bull.* 55, 1–19.—This bulletin gives data concerning the disposition of street sweepings and a table of analyses.

The Chemistry of the Corn Kernel. By C. G. Hopkins. *Univ. Ill. Agr. Expt. Sta. Bull.*, 53, 180a–180d.—This bulletin is an abstract of the work done at the Station in analyzing the constituents of the corn kernel in order to determine their exact composition.

Foods and Food Adulterants. By H. W. Wiley and others. *U. S. Dept. Agr., Div. Chem., Bull.* 13, 1169–1374.—This portion of the bulletin is devoted to cereals and cereal products. It contains brief descriptions of the processes of milling and tables of analyses showing the composition of a great variety of cereals and cereal products, as bread, rolls, cake, etc. In most cases the calories of combustion have been calculated for the cereals, while in a few cases the heat of combustion has been determined by direct experiment.

G. W. Rolfe, Reviewer.

Sugar Beets. By M. B. Hardin. *S. C. Agr. Expt. Sta. Bull.*, 34, 3–9.

Sugar Beets in Idaho. By Chas. W. McCurdy. *Univ. of Idaho Agr. Expt. Sta. Bull.*, 12, 37, 73.

New Mexico Sugar Beets, 1897. By Arthur Goss. *New Mexico Coll. Agr. Expt. Sta. Bull.*, 26, 71–113.

Sugar Beets in Colorado in 1897. By W. W. Cooke and W. P. Headden. *State Agr. Coll. Expt. Sta. Bull.*, 42, 3–64.

Sugar Beet Investigations in 1897. By A. D. Selby and L. M. Bloomfield. *Ohio Agr. Expt. Sta. Bull.*, 90, 123–162.

Wyoming Sugar Beets. By E. E. Slosson. *Univ. Wy. Agr. Coll. Bull.*, 36, 189–205.—These bulletins are typical of the class which are being issued by the Agricultural Experiment Stations throughout the country. They contain many interesting analytical data in various lines of research besides being popular manuals of beet culture.

A Soil Study. Part I. The Crop Grown: Sugar-Beets. By W. P. Headden. *Col. State Agr. Coll. Bull.*, **46**, 3–63.—This treats of an investigation of the effect of certain mineral salts, particularly alkalies, on the growth of sugar-beets. A great number of valuable data are presented. The conclusions arrived at are too many to be detailed here. In general, they show that in amounts even as small as a few hundredths of a per cent. in the soil, alkalies have a strong toxic action on the growing plant. Even extremely small quantities of alkali increase the ash of the beet notably. Much light is thrown, by these experiments, on the distribution of mineral matter through the tissues of the plant and the conditions of its assimilation.

Laboratory Notes. By F. H. Storer. *Bussey Inst. Harvard Univ. Bull.*, **2**, 409–421.—In the main these notes describe a continuation of researches on the carbohydrates of tree trunks, dealing principally with the pentosan group. (A) With the idea that hemicellulose (xylan) is difficultly digestible and generally more stable than the other carbohydrates the author has examined decaying birchwood, but finds much less gum than in sound timber. (B) The details are given of an elaborate investigation of the carbohydrates and derived products. (C) The solvent action of alkaline solutions on the xylan of coniferous wood under various conditions, and its bearing on the accuracy of the results of analyses are treated at length. (D) The amount of wood gum in the strawberry is shown to be small. (E) The possible presence of xylan in the membrane of the starch grain in the light of experimental evidence collected is discussed. (F) An analysis is given of the ashes of Javan sugar-baskets, disposed of at the refineries by burning, which shows that they are inferior to wood ashes for fertilizer.

Notes on Taka-Diastase. By W. E. Stone and H. E. Wright. *J. Am. Chem. Soc.*, **21**, 639–647.—A comparative investigation of the hydrolyzing action of malt- and taka-diastase infusions on potato starch paste. Taka-diastase evidently acts more energetically than malt-diastase up to a certain point, but does not, under the hydrolyzing conditions used by the author, carry the conversion nearly as far. In starch determinations, the use of taka-diastase was found objectionable, owing to incompleteness of its solvent action. The reviewer suggests that much might be learned by an investigation of the carbohydrates formed under varying conditions of hydrolysis by methods similar to those used by Brown and Morris on malt-diastase conversions. It would certainly be interesting to compare the curve of copper reduction with that of malt-diastase hydrolyzed products.

METALLURGICAL CHEMISTRY.

H. O. HOFMAN, REVIEWER.

Improvements in Mining and Metallurgical Apparatus during the Last Decade. BY E. G. SPILSBURY. *Trans. Am. Inst. Min. Eng.*, 27, 452–465.—A presidential address.

Silver-Lead Blast Furnace Construction. BY H. V. CROLL. *Eng. Min. J.*, 65, 639–640.—The paper is an illustrated description of some of the leading improvements that have been made during the last ten years in the constructive details of lead blast furnaces, especially in Colorado and Utah.

Recent Advances in Silver-Lead Smelting. BY R. H. TERHUNE. *Min. Sci. Press*, 77, 132–133.—The paper represents an address delivered by the author last July, at Salt Lake City, before the International Mining Congress, and is therefore rather general in character. The work of the Ropp Straight-Line Mechanical Roasting Furnace, which the author introduced at the Hanauer Works in 1896, is given in more detail than any other subject discussed.

The Condition in which Zinc Exists in Lead. BY M. W. ILES. *School Mines Quart.*, 19, 197–200.—Zinc can be present in a lead blast furnace slag as oxide, silicate, and sulphide. Of these the oxide is readily soluble in dilute sulphuric acid, the silicate less so, the sulphide not at all. The author treated finely pulverized slag with sulphuric acid of different degrees of concentration, for 25 hours, and found that part of the zinc only went into solution, and then very slowly. He concludes from this that zinc is present chiefly in the form of silicate. He proved that some zinc is present as sulphide by blowing compressed air through molten slag and analyzing the fumes which had been caught by sucking the gases through muslin and woollen filters. The analyses showed the presence of lead, zinc, silver, traces of gold and copper, and of sulphur and sulphur trioxide.

The Distribution of Precious Metals and Impurities in Copper and Suggestions for a Rational Method of Sampling. BY E. KELLER. *Trans. Am. Inst. Min. Eng.*, 27, 106–123.—This paper has been previously published (*J. Am. Chem. Soc.*, 19, 243–258) and reviewed (*this Rev.*, 3, 98–99).

The Jeffrey Double-Strand Scraper Conveyor. By R. P. Rothwell. *Eng. Min. J.*, **66**, 341.—A short illustrated description of a conveyor intended for the charging of ore into leaching vats. With the large capacities of the vats used in cyaniding low-grade gold ores, the introduction of mechanical devices for charging is becoming of increasing importance.

The Potsdam Gold Ores of the Black Hills. By F. C. Smith. *Trans. Am. Inst. Min. Eng.*, **27**, 404–428.—The main part of this paper discusses the occurrence and the general character of the siliceous silver-bearing gold ores near Deadwood, S.D. It gives also a brief outline of the three processes by means of which they are treated; *viz.*, barrel chlorination (Golden Reward Co., 39,000 tons; Kildonan Milling Co., 36,000 tons), cyaniding (Black Hills Gold and Extraction Co., 6,500 tons), and smelting with pyrite and copper ore for matte (Deadwood and Delaware Smelting Co., 65,700 tons). There are shipped outside 4,800 tons, making a total annual product of 152,000 tons.

Note on the Influence of Temperature in Gold Amalgamation. By F. F. Sharpless. *Eng. Min. J.*, **66**, 183.—The author, contributing to the discussion given in the title, found that with increase of temperature of battery-water, the amalgam became harder until with the water at 83° F., quicksilver ran off from the lower plates into the trap, which forced him to hang up the stamps. He was using old plates, and from the upper parts the silver had all been worn off. These worked well with warm water, while the lower parts, which were still well silvered, would not retain even the quicksilver that rolled off from upper parts.

Testing Oxidized and Pyritic Gold Ores. By P. H. van Diest. *Min. Sci. Press*, **76**, 568.—The paper embodies practical hints for the amalgamator and contains a few remarks about chlorinating and cyaniding.

The Chlorination Mill at Colorado City. By H. V. Croll. *Eng. Min. J.*, **66**, 425–426.—The paper is an illustrated description of a barrel-chlorination plant intended to treat Cripple Creek gold ores. Special attention appears to have been given to the cheap handling of ores. There is a large ore-bedding floor, having a capacity of 7,000 tons. The ore is dried and roasted in mechanical furnaces. The mill has 10 barrels, 6′ in diameter and 12′ long, receiving each a charge of 9 tons of ore, which is chlorinated in from 1 to 3 hours. The barrels have coarse sand filters inclosed in finely perforated sheet lead. These are to retain the larger part of the pulp; the fine slimes passing through them are removed by filter boxes placed in a separate building.

Cyanide and Chlorination in Colorado. BY R. B. TURNER. *Rep. State Bureau Mines, 1897*, 127–132.—The paper discusses the economic rather than the chemical features of the two processes as carried out to-day in Colorado. Thus the cost of cyaniding in a 50-ton plant is given as $2.70 per ton of raw ore, to which $0.75 may have to be added for roasting and $0.45 for sampling.

The Cyanide Process. BY S. B. CHRISTY. *Trans. Am. Inst. Min. Eng.*, **27**, 821–846.—A discussion by E. B. Wilson, A. James, and G. A. Packard.

Analyses of Cyanide Mill Solutions. BY W. J. SHARWOOD. *Eng. Min. J.*, **66**, 216.—The changes mill solutions undergo are shown by nine complete analyses made by the author. The table gives also the tons of solutions from which the samples were taken, the time they were in use, the general character, size, and tons of ore treated by the solutions. The accompanying text discusses in detail the character of the ores, the manner of working in the mills, and the methods followed in analyzing.

The Precipitation of Gold by Zinc Thread from Dilute and Foul Cyanide Solutions. BY A. JAMES. *Trans. Am. Inst. Min. Eng.*, **27**, 278–283.—The precipitation of gold from very dilute solutions is found to be defective in some cases; in others the gold from solutions with less than 0.05 per cent. free cyanide is reduced to below one grain per ton. The author found that the imperfect precipitation is sometimes caused by the shavings being too coarse and not packed tightly enough in the precipitation bases, which often are too shallow. Their depth ought to be greater than either the width or the length. Further, by giving the solutions a longer contact with the zinc and by making them slightly alkaline with caustic soda, they are easily freed from their gold; thus, a flow at the rate of 1 ton solution per 24 hours for each cubic foot of zinc shavings and an addition of one-half pound of caustic soda per ton of solution are usually sufficient. With very foul solutions, containing no free cyanide, a flow of one-half ton solution per cubic foot of shavings in 24 hours, will remove the gold. Solutions containing 0.2 per cent. copper were effectively treated as long as the flow was slow enough and the acidity had been neutralized with caustic soda.

The Influence of Lead on Rolled and Drawn Brass. BY E. S. SPERRY. *Trans. Am. Inst. Min. Eng.*, **27**, 485–505.—The author examined systematically the influences varying percentages of lead have on a brass composed of sixty per cent. copper and forty per cent. zinc, keeping the copper constant and replacing parts of the zinc by lead. Cuttings from such a brass free from lead are long and tenacious, so that a very low speed must be employed in cutting; when, however, two per cent. lead are added (leaded brass), the chips are very short and a high speed can be employed in cutting. Clock-brass and screw, or drill-rod brass, are common varieties of leaded brass.

The Influence of Lead on Rolled and Drawn Brass. BY F. FIRMSTONE. *Trans. Am. Inst. Min. Eng.*, **27**, 977–978.—The author discusses the subject treated in the article abstracted in the preceding review, and brings out the fact that as early as 1818 Berthier had called attention to the effect of lead on brass.

A Combination Retort and Reverberatory Furnace. BY COURTNEY DEKALB. *Trans. Am. Inst. Min. Eng.*, **27**, 430–436.—The paper is an illustrated description of a reverberatory furnace with a single zinc-retort, 9½x36 inches outside dimensions. It is the one used in the metallurgical laboratory of the Rolla School of Mines for the reduction of roasted zinc ores.

Zinc Smelting in the Joplin District. BY E. HEDBURG. *Mines and Minerals*, **19**, 103–104.—The main value of this paper lies in the figures of cost that it gives of the smelting of blende in Southwestern Missouri. It enumerates the leading zinc works in the Central Western States, gives an outline of roasting in a 2-hearth hand reverberatory furnace, and of reducing in a double direct-fired Belgian furnace, with 56 retorts, (7′ long, and 8″ in diameter) on a side. The cost is given in full for a plant having six double retort-furnaces, or 682 retorts in all. For details the reader is referred to the original.

Notes on Six Months' Working of Dover Furnace, Canal Dover, Ohio. BY A. K. REESE. *Trans. Am. Inst. Min. Eng.*, **27**, 477–485.—The iron blast furnace, the work of which is described in the paper, was built in 1895. It is 75′ high, the crucible 10′6″ in diameter, and 5′6″ deep, the bosh 16′6″ and the stock line 12′6″ in diameter. It has a Y-shaped downcomer, taking the gases from two openings in the furnace. For details the reader is referred to the original.

The Recovery of Iron from Cupola Cinder. BY W. J. KEEP. *Iron Age*, **61**, 6.—In iron foundries there is a considerable loss of metal in the form of small shots in cinders and skulls. Thus, every ton of dirt that goes from the common cinder mill to the dump contains about 300 pounds of shot, and the skulls from 100 ladles about 75 pounds iron. In order to recover this waste, the author uses a horizontal wet-crushing revolving cylinder, 30" in diameter and 40" long on the inside, having a longitudinal, star-shaped iron roller which breaks up the cinder while the barrel revolves. The finely-crushed cinder, coke, dirt, etc., are carried out automatically, leaving behind the clean shots of metal.

Sulphur in Embreville Pig Iron. BY G. R. JOHNSON. *Trans. Am. Inst. Min. Eng.*, **27**, 243–249.—The author investigated the distribution of sulphur in Embreville (Tenn.) pig iron. He obtained fractions from 43 pigs and took 9 samples from each fracture and analyzed them separately for sulphur. In addition, he determined from the average of each set of nine samples the sulphur, silicon, and phosphorus. The results show that the top of a pig is always richer in sulphur than the bottom. The author attributes this fact to the pig's giving off, during solidification, included gases, particularly sulphur dioxide, which cannot escape completely. He believes also that the rough surfaces especially of pig irons low in silicon are due to the escape of sulphur dioxide rather than to a small percentage of silicon.

The Micro Structure of Steel and the Current Theories of Hardening. BY A. SAUVEUR. *Trans. Am. Inst. Min. Eng.*, **27**, 846–944.—A discussion by A. Ledebur, R. A. Hadfield, H. C. Jenkins, J. O. Arnold, H. D. Hibbard, P. H. Dudley, E. D. Campbell, F. Osmond, H. M. Howe, and the author.

The Calorific Value of Certain Coals as Determined by the Mahler Bomb. BY N. W. LORD AND F. HAAS. *Trans. Am. Inst. Min. Eng.*, **27**, 259–271.—The principal aim of the paper is to determine the calorific powers of a number of coals in general use in Ohio and to find out whether analytical data can be safely used for their values. For this purpose forty samples of coal, each weighing 50 pounds, were obtained; *viz.*, 11 samples from Upper Freeport coal (O. and Pa.), 7 from Pittsburg coal, 11 from Middle Cittanning (7 Darlington coal, Pa., and 4 Hocking Valley coal, O.), 4 from Thacker coal (W. Va.), 5 from Pocahontas coal (Va.), and 1 from Mahoning coal (O.). Ultimate and proximate analyses were made of each. The calorific powers were determined with the Mahler bomb and calculated from the Dulong formula including the values for sulphur. The tables of results give also: The differences between the determinations and the calculations of the calorific powers; the average analyses and heating powers of the single seams; and the heating power of each sample calculated from the average heating power of the seam to which it belongs. The results show that for the coals examined the values calculated from the ultimate analyses agree within 2 per cent. with those obtained with the Mahler bomb. They also prove that the method suggested by Kent (*The Mineral Industry*, 1, 97) of calculating the calorific power from the fixed carbon obtained in the proximate analysis does not give satisfactory results. Finally, by comparing the calorific powers of the different samples from a single seam with an average of all the calorimetric tests, ash and moisture being excluded, results are obtained which show that the actual coal of a given seam, at least over considerable areas, has a uniform heating value.

The Calorific Value of Certain Coals as Determined by the Mahler Bomb. By W. Kent. *Trans. Am. Inst. Min. Eng.*, 27, 946–961.—This is a discussion of the preceding paper.

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HENRY P. TALBOT, Associate Editor.

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REVIEW OF AMERICAN CHEMICAL RESEARCH.

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ARTHUR A. NOYES, Editor; HENRY P. TALBOT, Associate Editor.
REVIEWERS: Analytical Chemistry, H. P. Talbot and W. H. Walker; Biological Chemistry, A. G. Woodman; Carbohydrates, G. W. Rolfe; General Chemistry, A. A. Noyes; Geological and Mineralogical Chemistry, W. O. Crosby; Inorganic Chemistry, Henry Fay; Metallurgical Chemistry and Assaying, H. O. Hofman; Organic Chemistry, J. F. Norris; Physical Chemistry, H. M. Goodwin; Sanitary Chemistry, E. H. Richards; Technical Chemistry, A. H. Gill and F. H. Thorp.

INORGANIC CHEMISTRY.

HENRY FAY, REVIEWER.

A Reduction of Permanganic Acid by Manganese Peroxide. BY H. N. MORSE AND C. L. REESE. *Am. Chem. J.*, **20**, 521–535.—In a previous paper (*this Rev.*, **2**, 85) it was shown that permanganic acid decomposes in presence of manganese dioxide and a reduction of the acid takes place with the liberation of three-fifths of its active oxygen. It was suggested later that this phenomenon might explain the evolution of oxygen which takes place when hydrogen or carbon monoxide is absorbed by a five per cent. acidified solution of potassium permanganate. H. Hirtz and V. Meyer maintained that the phenomenon of the evolution of oxygen observed by Meyer and Von Recklinghausen was fundamentally different from that observed by Morse, Hopkins, and Walker, because the latter experimented only with *neutral* solutions, and the evolution of oxygen which occurs *during the absorption* is much more rapid than that which takes place *after the exhaustion* of the gas. The authors point out that the first objection is invalid; for out of 48 experiments 35 were made with acidified permanganate solution. In regard to the second objection, the suggestion is offered that the rapid initial evolution of oxygen is in some way connected with the nature of the gaseous reducing agent or that the initial peroxide molecules are of greater simplicity. Meyer and von Recklinghausen obtained about 1.9 to 2.9 cc. of oxygen when air was shaken with a five per cent. acidified solution of potassium permanganate which had been previously boiled, and they believed that there was a definite limit to the evolution of oxygen. The authors show that boiling with sulphuric acid produces manganese dioxide, which may be the cause of the decomposition, and that there is a gradual, but continuous, decomposition with continued shaking. Working with three solutions which contained respectively 2.822, 5.644, and 51 milligrams of $KMnO_4$ in each cubic centimeter, and which had been filtered through two layers of asbestos, it was shown that the two weaker solutions suffered no appreciable loss of oxygen when shaken 150 to 300 hours, whether the acid added was equivalent to once or six times the potassium of the permanganate. In the strongest solution there was no appreciable loss of oxygen except when the acid present amounted to three times that of the potassium, and even then after agitating 150 hours was not so large as that observed by Meyer and von Recklinghausen. A series of experiments were made to determine the relative rates of reduction when equal volumes of permanganic acid are agitated, on the one hand with a given volume of hydrogen, and on the other with a quantity of peroxide which is equal to that produced by the absorption of all of the hydrogen. The same three solutions were used and were shaken at times varying from 24 to 300 hours and with acid equivalent to all of the potassium and to three times as much. The experiments show that hydrogen as a reducing agent is much more efficient during the first 24 hours than manganous sulphate with the two stronger solutions. During the period from 24 to 150 hours, the oxide produced by hydrogen acted much more rapidly in the permanganate solution containing 51 milligrams $KMnO_4$ than the oxide produced by the manganous sulphate. In the two more dilute solutions this order is reversed. During the period of shaking, from 150 to 300 hours, the oxide produced by hydrogen was decidedly less active than that from manganese sulphate. In the presence of oxide there seems to be no limit to the reaction until all of the permanganic acid is used up.

On the Metaphosphimic Acids (III). By H. N. Stokes. *Am. Chem. J.*, **20**, 740–760.—In two preceding papers (*this Rev.*, 3, 4–7) the author has described trimetaphosphimic and tetrametaphosphimic acids obtained from the corresponding phosphonitrilic chlorides, $P_3N_3Cl_6$ and $P_4N_4Cl_8$. He now prepares and describes the next higher members of this series, the pentametaphosphimic and hexametaphosphimic acids, $P_5N_5(OH)_{10}$ and $P_6N_6(OH)_{12}$, by acting on the chlorides with sodium acetate. It is found that there is a close analogy between this series of acids and the series of methylene ring hydrocarbons, and that with respect to stability, power of forming lactones, and the nature of the decomposition-products, the properties of these acids may be explained by stereochemical considerations analogous to those of von Baeyer on the methylene hydrocarbons and of Wislicenus on the lactones. Assuming that the metaphosphimic acids are phosphorus-nitrogen ring compounds, and that the mean angle for an eight-membered ring, which is the most stable condition, is 135°, the properties of the other acids may be deduced from this. From the following table it will be seen that as we ascend in the series there is a very rapid increase of stability to a maximum, followed by a gradual decrease. This is in accordance with the experimental data. $P_5N_5(OH)_{10}$ is less stable than $P_4N_4(OH)_8$, but markedly more stable than $P_3N_3(OH)_6$, corresponding to the difference of only 9° from 135° in one case against 15° in the other.

Ring.	Number of sides.	Mean angle.	Difference from 135°.
PN	2	0°	—135°
P_2N_2	4	90°	— 45°
P_3N_3	6	120°	— 15°
P_4N_4	8	135°	0°
P_5N_5	10	144°	+ 9°
P_6N_6	12	150°	+ 15°
P_7N_7	14	154.3°	+ 19.3°
P_8N_8	16	157.5°	+ 22.5°

The acids containing 1 and 2 atoms of phosphorus are unknown; those containing 3, 4, 5, and 6 atoms of phosphorus have been isolated and exist in two atoms, the lactam form, $(PNO_2H_2)_n$, where *n* is either 3, 4, 5, or 6, which is formed only in neutral or acid solution and the open chain form $(PNO_2H_2)_n + H_2O$ formed under the influence of alkali. The acid corresponding to the chloronitride, $P_7N_7Cl_{14}$, and possibly those from the higher members, exist only in the open chain form. The higher members of the series break down into the more stable form containing four atoms of phosphorus. Pentametaphosphimic acid breaks down under the influence of mineral acids into tetrametaphosphimic acid, triimidotetraphosphoric acid, diimidotriphosphoric acid, and orthophosphoric acid. The sodium and silver salts of penta- and hexametaphosphimic acids in which the metals replaced one-half of the hydrogen, were prepared. Unsuccessful attempts were made to prepare the amides of the metaphosphimic acids by treating the chloronitrides with strong ammonia.

On the Claims of Davyum to Recognition as a Chemical Element. By J. W. Mallet. *Am. Chem. J.*, 20, 776–783.—Davyum has been described by Kern as having been obtained from platinum ores. He found its atomic weight to be 154, and one of its characteristics was the insoluble double sodium salt. The material investigated by the author was obtained from a London manufacturer of platinum: the filtrate from the aqua regia solution, after decantation from osmiridium and separation of the platinum by means of ammonium chloride, had been evaporated to dryness with sodium chloride. On taking this up in a small quantity of water, the insoluble residue, where davyum should be found, was proved by the author to be a mixture of finely divided quartz, zircon, and osmiridium. In the precipitation of platinum from certain liquors, ammonium chloride saturated with sodium chloride is used. By evaporation of the filtrate there was formed a buff-colored powder consisting of octahedra. The metal was reduced by pure zinc, dissolved in aqua regia, the sodium double salt again made, dried, weighed, and reduced in hydrogen. Assuming the formula for the double salt to be Na_2MCl_6, the atomic weight of the metal was deduced as 151.5, which agrees closely with Kern's value. The properties of the metal obtained were similar to those described for davyum, but it was shown to consist of iridium and rhodium in about equal amounts and of a trace of iron.

The Formation of Alums by Electrolysis. By JAS. LEWIS HOWE AND E. A. O'NEAL. *J. Am. Chem. Soc.*, 20, 759-765.—Solutions of metals in the lower state of oxidation were electrolyzed in a platinum dish, which formed the positive electrode, in presence of sulphuric acid and the different alkali sulphates. The rubidium and caesium iron alums and the rubidium and caesium cobalt alums were prepared in this way.

Derivatives of the Tetrachlorides of Zirconium, Thorium, and Lead. By J. MERRITT MATTHEWS. *J. Am. Chem. Soc.*, 20, 815-839.—By bringing together ethereal solutions of the tetrachlorides of zirconium, thorium, and lead, with different substituted ammonias, direct addition takes place. Four molecules of methyl, ethyl, and propyl amines are added to each of the tetrachlorides. Zirconium tetrachloride combines with four molecules both of aniline and toluidine; thorium tetrachloride with four of aniline and three of toluidine; and lead tetrachloride with three of aniline, decomposing toluidine. Two molecules each of pyridine, quinoline, and naphthylamine combine with zirconium tetrachloride, one each with thorium tetrachloride, while lead tetrachloride combines with one of pyridine and naphthylamine, and two of quinoline. Under different conditions eight, six, and two molecules of ammonia add directly to zirconium tetrachloride; eight and six to thorium tetrachloride; and four to lead tetrachloride.

Derivatives of the Tetrabromides of Zirconium and Thorium. By J. MERRITT MATTHEWS. *J. Am. Chem. Soc.*, 20, 839-843.—Zirconium tetrabromide adds itself directly to four molecules of ammonia, ethylamine, and aniline, and to three of pyridine; thorium tetrabromide adds directly to one molecule of pyridine, three of ammonia, and four of ethylamine and aniline.

Review and Bibliography of the Metallic Carbides. By J. A. MATHEWS. *Smithsonian Miscellaneous Collections, No.* 1090, 1-32.

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GENERAL AND PHYSICAL CHEMISTRY.

A. A. NOYES, REVIEWER.

New Experiments on the Quantitative Synthesis of Water. BY EDWARD H. KEISER. *Am. Chem. J.*, **20**, 733-739.—The apparatus and method employed were as follows: A glass tube 5½ cm. in diameter, with a slight constriction two-thirds of the way down, was drawn out at the bottom and fused to a glass stop-cock, and was closed at the top with a ground glass cap provided with a three-way cock. The lower compartment of the tube, below the constriction, was filled with sublimed phosphorus pentoxide. The cap was put on, and the tube was evacuated with a Töpler air-pump and weighed. The cap was then removed, and a cylindrical tube, open above and perforated with a number of small holes near the bottom, filled with palladium sponge prepared by reduction with hydrogen, was inserted in the upper compartment above the pentoxide. The cap was instantly replaced, the tube exhausted, and a second weighing made. Hydrogen, made by electrolyzing dilute sulphuric acid and purified by passing through caustic potash, over heated palladium, to convert any oxygen present to water, and finally through U-tubes containing solid potash and phosphorus pentoxide, was slowly admitted through the three-way cock, until the palladium had become saturated. Then the excess of gas, together with any impurities contained in the total amount absorbed, was pumped out, and a third weighing made. The difference between this and the second weight was the amount of hydrogen converted into water by the next operation. This consisted in admitting very gradually electrolytic oxygen purified in the same way as the hydrogen. The union with the hydrogen absorbed in the palladium occupied four to five hours, and an excess of oxygen was then allowed to stand in the tube over night. This was then removed by drawing it out at the bottom through the phosphorus pentoxide, and the evacuated apparatus was weighed a fourth time, the difference between the third and fourth weights giving the weight of oxygen that had combined with the hydrogen. Finally, dry air was admitted, the cap was removed, the inner tube with the palladium taken out, the cap replaced, and the apparatus again weighed after evacuation. The difference between this last weight and the first one of all is the weight of water absorbed by the pentoxide. This should check, of course, with the sum of the weights of oxygen and hydrogen, if there is no error from incomplete drying of the gases or leakage. This was found to be very nearly the case in four out of the six experiments that were carried through. The data of these four experiments, which alone are communicated, are as follows :

				At. wt. O (H = 1).	
Wt. of H.	Wt. of O.	Sum of H+O.	Weight of H_2O found.	From H_2:O.	From H_2:H_2O.
0.27549	2.18249	2.45798	2.45975	15.846	15.858
0.27936	2.21896	2.49832	2.49923	15.886	15.892
0.27091	2.15077	2.42168	2.42355	15.880	15.892
0.26845	2.13270	2.40115	2.40269	15.890	15.900
			Mean,	15.874	15.886

The mean of the two averages is 15.880, which is in complete agreement with the value found by Morley and other recent investigators.

On the Cause of the Retention and Release of Gases Occluded by the Oxides of the Metals. BY THEODORE WILLIAM RICHARDS. *Am. Chem. J.*, **20**, 701–732.—Experiments are first described which show that samples of cupric oxide, prepared by heating cupric nitrate under different conditions, occluded and set free on treatment with acid, after being ignited for from ½ to 20 hours at temperatures varying from 500° to 830°, 0.55–0.70 cc. of gas for each gram of oxide. The amount of gas varies within the limits just stated with the original method used for converting the nitrate to oxide, but is independent in the case of a definite sample of the duration and temperature of the subsequent ignition as long as the temperature does not exceed 830°. Between 870° and 950°, however, most of the gas is gradually expelled, the rapidity depending on the temperature, and only about 0.05 cc. remains after ½ to 2 hours ignition at 950°. Similar experiments with zinc oxide prepared from zinc nitrate showed, on the other hand, that one gram of it retains, after heating for three hours at 660°, 0.37 cc. ; at 750°, 0.22 cc. ; and at 880°, 0.16 cc. of gas. The amount retained is thus seen to be dependent on the temperature of the ignition, and a special series of experiments showed that it also varies with its duration, and markedly with the method of preparation of the sample of oxide. Zinc oxide prepared from the carbonate contained no gas, and that prepared by heating the nitrate to 280° contained only 0.015 cc., previous to its ignition at higher temperatures. These facts make it clear that the occluded gas arises from the decomposition of a residue of basic nitrate left in the oxides in their preparation at low temperatures. Interesting experiments were also made on the proportions of oxygen and nitrogen in the gas in relation to the temperature and duration of the ignition, and it was found that both with copper and zinc oxide, as well as with magnesium oxide which had been previously investigated, the proportion of oxygen was much less, the higher the temperature and the longer the ignition. For example, the gas obtained by heating zinc oxide at 660° for three hours contained more than 60 per cent. of oxygen, while that from the oxide kept at 880° for the same time contained less than 20 per cent., the absolute amount of nitrogen per gram being nearly the same in the two cases. The oxygen, therefore, escaped much more readily than the nitrogen. In order to explain this phenomenon, which cannot be due to diffusion or transpiration, the author assumes that the oxides are in a state of partial dissociation, and the continual formation and decomposition of oxide molecules enables the oxygen to pass out from within the solid particles. In support of this hypothesis, among other things, he proves that cupric oxide heated to 790° *in a vacuum* evolves nearly pure oxygen.

The Solubility of Salts of Weak Acids in Stronger Acids. By Arthur A. Noyes and David Schwartz. *J. Am. Chem. Soc.*, 20, 742–751.—The authors have determined the solubility of silver benzoate in nitric and chloracetic acid solutions of various strengths, and have developed mathematically the theory of this phenomenon by applying the principles of mass action and electrolytic dissociation. The calculated effect of the acids in increasing the solubility agrees well with that observed.

The Solubility of Acids in Solutions of the Salts of Other Acids. By Arthur A. Noyes and Edward S. Chapin. *J. Am. Chem. Soc.*, 20, 751–756.—The solubility of benzoic acid in sodium acetate and sodium formate solutions of various concentrations was determined. The theory of the effect is the same as in the preceding investigation, and close agreement between the observed and calculated values was found here also.

Benzaldoxime. By Frank K. Cameron. *J. Phys. Chem.*, 2, 409–416.—The author has investigated the equilibrium conditions between the two stereoisomerie forms of benzaldoxime. He concludes that both forms exist in the liquid condition and that their relative concentrations are independent of the temperature. The stable triple point is 27.7° and at this point the mixture contains 94 per cent. of the α modifications. The eutectic point is at 25°–26°, the mixture then containing 91 per cent. of the α compound.

The Isothermal Pressure-Surface in the Case of Two Single Salts and One Double Salt. By F. G. Donnan. *J. Phys. Chem.*, 2, 417–420.

The Molecular Weight of Orthorhomic, Monoclinic, and Plastic Sulphur in Naphthalene and Phosphorus by the Freezing-point Method. By Samuel D. Gloss. *J. Phys. Chem.*, 2, 421–426.—The author concludes from his experiments that there is no difference in the molecular weights of the three forms of sulphur mentioned in the title in either of the two solvents mentioned.

Potassium Chloride in Aqueous Acetone. By J. F. Snell. *J. Phys. Chem.*, 2, 457–491.—The author communicates the results of experiments in which the temperatures were determined at which numerous mixtures of the three substances, water, acetone, and potassium chloride, separated into two layers. These temperatures lie for the most part between 32° and 110°. He found that even at a very much higher temperature (250°–300°) such solutions do not in any case again become homogeneous. He has also determined the temperature of division of various mixtures of water and acetone saturated with potassium chloride, and the solubility at 30° and 40° of this salt in such mixtures. The graphic representation of the equilibrium conditions involved is discussed at length.

Alcohol, Water, and Potassium Nitrate. By Norman Dodge and L. C. Graton. *J. Phys. Chem.*, 2, 498–501.—The authors have determined the temperatures at which various mixtures of water and alcohol containing from 13 to 85 per cent. of the latter separate into two distinct layers when kept saturated with potassium nitrate. These temperatures lie between 80° and 144°. The temperature of separation was found in one case to be 15° lower when an excess of potassium chloride was added at the same time with the excess of potassium nitrate.

[CONTRIBUTION FROM THE MASSACHUSETTS INSTITUTE OF TECHNOLOGY.]

REVIEW OF AMERICAN CHEMICAL RESEARCH.

VOL. V. No. 3.

ARTHUR A. NOYES, Editor; HENRY P. TALBOT, Associate Editor.
REVIEWERS: Analytical Chemistry, H. P. Talbot and W. H. Walker; Biological Chemistry, A. G. Woodman; Carbohydrates, G. W. Rolfe; General Chemistry, A. A. Noyes; Geological and Mineralogical Chemistry, W. O. Crosby; Inorganic Chemistry, Henry Fay; Metallurgical Chemistry and Assaying, H. O. Hofman; Organic Chemistry, J. F. Norris; Physical Chemistry, H. M. Goodwin; Sanitary Chemistry, E. H. Richards; Technical Chemistry, A. H. Gill and F. H. Thorp.

GENERAL AND PHYSICAL CHEMISTRY.

A. A. BLANCHARD, REVIEWER.

Cyclical Law of the Elements. BY THOMAS BAYLEY. *J. Am. Chem. Soc.*, 20, 927–934.—The author discusses Lothar Meyer's curve of atomic weights and atomic volumes, and presents evidence that the sixth loop or cycle embraces elements with atomic weights between that of caesium and that of an unknown alkali metal of atomic weight 223, instead of 170, as Lothar Meyer suggested.

Atomic Volume as a Periodic Function. BY THOMAS BAYLEY. *J. Am. Chem. Soc.*, 20, 935–948.—Constructing an atomic volume curve like that of Lothar Meyer, drawing ordinates through the points that mark the transitions from cycle to cycle which occur just before the alkali metals, lithium, sodium, potassium, rubidium, caesium, and the value 223.7, and drawing abscissae at points corresponding to atomic volumes of 30, 60, 90, 120, etc., the author shows that it is possible to draw straight lines through their intersections, which will also pass through the positions of two or more elements, and that there is a remarkable regularity in the properties of the elements located upon these lines. The position and properties of numerous unknown elements in the sixth, seventh, and eighth cycles are also shown by extending the system of lines.

ANALYTICAL CHEMISTRY.

ULTIMATE ANALYSIS.

H. P. TALBOT, REVIEWER.

I. Metal Separations by Means of Hydrobromic Acid Gas. II. Indium in Tungsten Minerals. BY ELIZABETH ALLEN

ATKINSON. *J. Am. Chem. Soc.*, **20**, 797–813.—It is shown that there is a marked similarity in the behavior of the metals when placed in an atmosphere of hydrobromic acid to that noted when hydrochloric acid is used. When volatilization of the bromine compounds occurs, however, it is less prompt than that of the chlorides, and certain of the metals, notably lead and cobalt, form oxybromides, while copper forms a cuprous bromide. Silver and cadmium are changed to bromides. Attempted separations of arsenic and iron in an atmosphere of hydrochloric acid as well as one of hydrobromic acid were both unsuccessful. The analysis of wolframite from Zinnwald and from Cornwall, of hübnerite from Colorado, and of scheelite from New Zealand and Bohemia showed the presence of indium only in the first-named mineral. This confirms the views of Hoppe-Seyler (*Ann. Chem.*, **140**, 247), that the indium in the specimen of wolframite from Zinnwald was probably present in the zinc blende. Zinc was absent from the other specimens.

IV. On the Separation of Iron from Zirconium and Certain Other Allied Metals. BY J. MERRITT MATTHEWS. *J. Am. Chem. Soc.*, **20**, 846–858.—Absolute ether, into which dry hydrochloric acid gas is passed, will separate the iron from a mixture of the zirconium and ferric compounds left after the evaporation of an aqueous solution of the chlorides on the water-bath, without dissolving any zirconium. The latter remains as the oxychloride, and the two metals may be quantitatively separated by this procedure. The same method was employed with practical success for the separation of iron from thorium, cerium, titanium, lanthanum, neodymium, and praseodymium.

The Determination of Sulphur in Asphalt. BY E. H. HODGSON. *J. Am. Chem. Soc.*, **20**, 882–889.—A comparison of the fuming nitric acid (Carius), deflagration, sodium peroxide, and Eschka methods leads the author to the conclusion that the first-named procedure gives the best results, but is long and precarious because of the bursting of the sealed tubes. Of the others, the author prefers the Eschka method.

On the Facilities for Standardizing Chemical Apparatus Afforded by Foreign Governments and Our Own. BY LOUIS A. FISCHER. *J. Am. Chem. Soc.*, **20**, 912–927.—The paper presents a brief history of the National Office of Standard Weights and Measures, and contains statements of the present facilities for the examination of instruments used by chemists, and the regulations governing this branch of the work of the office. The provisions made by foreign governments for similar purposes are briefly stated. A device for marking flasks for volumetric analysis is described in detail.

Some Errors in the Determination of Nitrogen. BY C. G. HOPKINS. *J. Am. Chem. Soc.*, **20**, 961–965.—In confirmation of Rempel's results (*Ztschr. angew. Chem.*, *1889*, 331), it is found that there is a loss of ammonia if its solution is exposed to the atmosphere during titration, even while dropping from a burette; and, also, that unless the tube from the condenser in the Kjeldahl method reaches to the bottom of the receiver containing the standard acid solution, the ammonia may accumulate in and supersaturate the upper layers, and escape.

W. H. WALKER, REVIEWER.

Further Separations of Aluminum by Hydrochloric Acid. BY FRANK STUART HAVENS. *Am. J. Sci.*, 156, 45–48.—The method of Gooch and Havens (*this Rev.*, 3, 30) for the separation of aluminum from iron is here extended with little variation to the separation of aluminum from zinc, copper, mercury, or bismuth. After removal of the aluminum, the ether-acid solution is evaporated to dryness and the remaining metal determined by one of the usual methods.

The Iodometric Determination of Molybdenum. BY F. A. GOOCH AND JOHN F. MORTON, JR. *Am. J. Sci.*, 156, 168–175. —In a former article (*this Rev.*, 2, 68), Gooch and Fairbanks pointed out certain inaccuracies in the iodometric determination of molybdenum as proposed by Friedheim and Euler, and recommended modifications by which such inaccuracies might be eliminated. To this criticism Friedheim took exception, and the authors, having carefully repeated the former work, devote the present article to a review of the subject, and give data which fully substantiate previous conclusions.

On the Determination of Manganese as the Pyrophosphate. BY F. A. GOOCH AND MARTHA AUSTIN. *Am. J. Sci.*, 156, 233–243.—The success of the analytical process by which manganese is determined as pyrophosphate depends upon the conversion of the amorphous trimanganous phosphate, $Mn_3P_2O_8$, which is at first precipitated, into the crystalline ammonium magnesium phosphate, $MnNH_4PO_4$. The conditions under which this change may be most easily and completely brought about have been very thoroughly studied by the authors. They find that a large excess of ammonium chloride is necessary for the transformation, and that the following procedure gives the most satisfactory results: The slightly acid solution, containing in a volume of 200 cc. an amount of manganese not more than enough to make 0.4 gram of pyrophosphate, 20 grams of ammonium chloride, and 5 to 10 cc. of a cold saturated solution of microcosmic salt, is precipitated in the cold by the careful addition of ammonium hydrate in slight excess. On heating, the precipitate quickly becomes silky and crystalline, and may be filtered, washed, and weighed as usual.

Detection of Sulphides, Sulphates, Sulphites, and Thiosulphates in the Presence of Each Other. By P. E. Browning and Earnest Howe. *Am. J. Sci.*, 156, 317–322.—The method of R. G. Smith (*Chem. News*, 72, 39) for the detection of the above-named radicals in the presence of each other has the two serious drawbacks, that the hydrochloric acid necessary to dissolve the barium sulphite and thiosulphate frequently breaks up the thiosulphate with the separation of sulphur, and that a very small precipitate of barium sulphate is difficult to recognize in solutions colored by iodine and bromine. The authors have been able to overcome these difficulties by using the following modifications of the original method: About 0.1 gram of the substance, dissolved in 10 cc. of water, is made slightly alkaline with ammonia or sodium hydroxide, and a little zinc acetate added, precipitating any sulphide present. The filtrate is made slightly acid with acetic acid, and the sulphate present thrown out of solution by means of barium chloride. Iodine is now added to the filtrate free from barium sulphate until the color is permanent, and the excess then removed by a few drops of a stannous chloride solution (to which has been added a little hydrochloric acid to prevent the precipitation of basic tin salts). A precipitation of barium sulphate at this point indicates that a sulphite was originally present. The thiosulphate which has been changed to tetrathionate by the iodine, is now further oxidized to sulphate by means of bromine water, the excess being removed by stannous chloride as before, and its presence is now indicated by a third precipitate of barium sulphate.

The Estimation of Boric Acid. By F. A. Gooch and Louis C. Jones. *Am. J. Sci.*, 157, 34–40.—Owing to the difficulty of obtaining definite conditions for weighing the calcium oxide used to retain and estimate boric acid when distilled with methyl alcohol from an acid solution, numerous substitutes have from time to time been proposed. The experimental data given in the present article show, however, that none of these are superior to calcium oxide if the precautions given in Gooch's original article are followed. A retainer which is much less hygroscopic and in every way suitable, is found by the authors in sodium tungstate which has been fused with a small excess of tungstic acid. It may be used in a manner similar to the other substances with very satisfactory results.

The Standardization of Volumetric Acid and Alkali. By W. A. Puckner. *Pharm. Archives*, 1, 172–184.—The advantages and disadvantages of a number of the substances frequently used for standardization are discussed, and a large number of experimental data are communicated. The writer, however, "refrains from drawing conclusions."

PROXIMATE ANALYSIS.

A. G. WOODMAN, REVIEWER.

On Acetic Acid as a Substitute for Ethyl Alcohol in Extracting the Active Principles of some Officinal Drugs. BY EDWARD R. SQUIBB. *Am. J. Pharm.*, 71, 1–14.—In order to measure the comparative capacity of alcohol and acetic acid for extracting the active principles of drugs, the author has made parallel extractions of nux vomica, a drug most difficult to extract completely. The results, obtained by the process of repercolation, using siphon percolators, show in general that by the substitution of the acetic acid menstruum for the alcoholic, one-half the cost of grinding, and five-sixths of the cost of menstruum, are saved, an equivalent product being obtained in larger quantity. The acid preparation has a larger proportion of inert extractive matter, but it gives much less precipitation on dilution than the alcoholic, and that which it does give is not liable to carry down alkaloids soluble in an acid solution. After trying various methods in the endeavor to secure a convenient and fairly accurate process of assay for the mixed alkaloids, the following procedure was adopted: 10 grams of nux vomica, ground to pass through a No. 9 sieve, is exhausted with 10 per cent. acetic acid. The percolate is evaporated to dryness on the water-bath and then dissolved in 10 cc. of a mixture of two volumes alcohol (91 per cent.), one volume ammonia water (10 per cent.), and one volume water. The alkaloids are extracted from this solution by a mixture of equal volumes of chloroform (99 per cent.) and ether (96 per cent.). The chloroform extract is evaporated, the soluble alkaloids taken out by warming with 10 cc. decinormal sulphuric acid, and the final solution titrated with decinormal potassium hydrate, using logwood as an indicator.

A Common Error in Recorded Results of Proximate Plant Analysis. BY LYMAN F. KEBLER. *Am. J. Pharm.*, 71, 25–26. —The author calls attention to the error caused by adding the percentage of ash to the percentage of the other constituents instead of estimating it in the dried residue left after the action of the various solvents.

Coumarin and Vanillin, Their Separation, Estimation, and Identification in Commercial Flavoring Extracts. BY WILLIAM H. HESS AND ALBERT B. PRESCOTT. *Pharm. Rev.*, 17, 7–9.—The method for the separation of vanillin and coumarin proposed by the authors, is based on the aldehydic character of vanillin, which is hydroxymethoxybenzoic aldehyde, while coumarin is the anhydride of coumaric (orthohydroxycinnamic) acid. From 25 to 100 grams of the commercial extract are heated at about 80° C. until the alcohol is evaporated, and a solution of lead acetate is added until no more precipitate forms. The filtered solution is extracted with ether, and the vanillin in the ether extract is shaken out with dilute ammonia. The ether solution is then evaporated over sulphuric acid, and the coumarin in the residue is taken up with ligroin, being obtained in crystals melting at 67° C. upon evaporation of the solvent. The ammoniacal solution is made slightly acid and shaken out with ether as before. After evaporation the vanillin is extracted from the residue by boiling ligroin. It gives a pure crystalline product melting at 80°–81° C. This method was found to give satisfactory results.

Emetine Octoiodide and the Extraction and Estimation of Alkaloids Generally. BY H. M. GORDIN AND A. B. PRESCOTT. *Am. J. Pharm.*, **71**, 14–21.—In estimating the alkaloids in medicinal drugs, the simplest and best method of obtaining the alkaloidal solution free from foreign matter is that of Lyons (*Manual Pharm. Assaying*, *1886*, 20). By evaporation of the highly volatile solvent used, however, the results are liable to be high; and, in order to avoid this, the authors have worked out a different method of alkaloidal extraction which is in general the same as that proposed by them for the assay of opium (*J. Am. Chem. Soc.*, **20**, 724; *this Rev.*, **4**, 115). The method was found to give good results with various drugs, with the exception of ipecac root. It was also found that the separate estimation of strychnine and brucine in nux vomica could be conveniently made by the periodide assay method together with a modification of the method of separation proposed by Dunstan and Short (*Am. J. Pharm.*, *1883*, 579). Emetine octoiodide was prepared and analyzed. It was obtained as a dark-brown powder, difficultly soluble in benzol, ether, or chloroform, quite readily soluble in alcohol, and very soluble in a mixture of alcohol and chloroform. It appears to be emetine hydriodide heptaiodide, $C_{28}H_{40}N_2O_5.HI.I_7$, corresponding to the formula for emetine found by Lefort and Wurz (*Ann. chim. phys.* (5), **12**, 247).

Comparison of Methods for Estimating Caffeine. BY E. F. LADD. *Am. Chem. J.*, **20**, 866–869.—The author has made comparative determinations of the value of four methods for the estimation of caffeine in tea. The methods employed were those of Vite, Peligot, Crosschoff, and Gomberg. The method of

Vite gave a loss of 10 per cent. on pure caffeine, and a loss of as much as 42 per cent. when working with tea. The other three methods gave good results with pure caffeine. The percentages of caffeine found in three samples of tea are given in the following table:

Method.	Congo tea.	Green tea.	Gunpowder tea.
Peligot	0.843	2.061	3.680
Crosschoff	0.919	2.031	3.200
Gomberg	1.542	2.386	3.986

The higher results given by Gomberg's method, together with its simplicity, make it the most desirable method for the rapid determination of caffeine.

Methods for the Determination of Color and the Relation of the Color to the Character of the Water. By Frederick S. Hollis. *J. N. E. Water Works Assoc.*, 13, 94–111.—The author shows by a series of analyses, extending over a year, that in an unpolluted surface water the variations in oxygen consumed, loss on ignition, and albuminoid ammonia, in general, follow the changes in color. Among the methods for the determination of color are described the Tidy colorimeter, the Nessler scale of Leeds, the method based on a comparison of the natural waters with the Lovibond tintometer (erroneously spelled Lovi*bard*), the platinum scale of Hazen, and the special form of colorimeter used at the Experimental Filter Station of the Boston Water Works. A table is given for the conversion of color readings from the Nessler and natural water standard to the platinum standard.

TECHNICAL CHEMISTRY.

F. H. Thorp, Reviewer.

The Influence of Bismuth on Brass and Its Relation to Fire-cracks. By Edwin S. Sperry. *American Machinist*, 21, 690–692.—The author investigated the truth of the maxim common among brass founders that bismuth is injurious in brass. Five experiments were made in which a pure Lake Superior copper was melted and a certain quantity of a definite alloy of copper and bismuth introduced. Pure refined zinc was then added and the brass cast in a mold. It was then rolled cold. The presence or absence of cracks on the edges and surface of the plate was noted. The plate was then annealed and again examined for fire-cracks; if these were not sufficiently deep to prevent further treatment, the plate was again rolled and examined. The amount of bismuth introduced varied from 0.5 per cent. to 0.02 per cent., and in all cases the amount of cracking was proportional to the quantity of bismuth present. Less than 0.02

per cent. bismuth would produce a satisfactory brass. The author believes he has demonstrated that bismuth is a cause of fire-cracks in brass, but it is not commonly present in sufficient quantities to be considered the *only* cause of them. His results in brief are: Bismuth renders brass cold-short, but has less effect than antimony in this respect; it causes fire-cracks, and brass for cold rolling should not contain over 0.01 per cent. of bismuth; it also causes hot-shortness and latent fire-cracks, *i. e.*, lines of inferior cohesion after annealing which develop into cracks when the brass is rolled.

The Variation in the Composition of "Paris Green," with a Scheme for Its Analysis. By Thomas B. Stillman. *Stevens Indicator*, 15, 233–240.—The composition of a pure Paris green is given as an aceto-arsenite of copper containing in per cent. CuO, 31.29; As_2O_3, 58.65; $C_2H_4O_2$, 10.06. Adulteration as such is rare in this country, but many samples show an excessive amount of arsenious acid, and the commercial material fails to give uniform results when used as an insecticide. Foreign samples are often found adulterated with barium sulphate, calcium carbonate, lead chromate, or gypsum; but these may be added to alter the shade when the material is designed for use as a pigment. A simple scheme for the analysis of Paris greens, containing the above impurities, is given.

Producing Illuminating Gas and Coke in By-Product Coke-Ovens. By H. O. Hofman. *Eng. Min. J.*, 66, 428–430; 458–460.—A study of the working of ten Semet-Solvay coke-ovens at Halifax, N. S., was made by the author. Since 1897 these ovens have supplied 18 candle-power gas to the city for illuminating purposes, while a fuel gas of 8½ candle-power is also obtained. Of the gas made, 32.26 per cent. is illuminating gas and 67.74 per cent. fuel gas; the latter is used to heat the retorts, and 54.84 per cent. of the total gas made is thus utilized; the remainder is sold for heating gas. Every 24 hours 37 tons (of 2,000 lbs.) are coked and yield 310,000 cubic feet of gas, while 75 per cent. of the weight of the coal charged is obtained as coke. Each ton of coal also yields about 5 lbs. of ammonia gas and 12 gallons of tar (120 lbs.). An abstract of a report on an Otto-Hoffmann oven, worked at Glassport, Pa., is also included. The coal used was a washed slack from the Dominion Coal Co., Cape Breton. With an average charge of 14591 lbs. of coal containing 9.9 per cent. moisture, the time of coking was 33 hours and 56 minutes. The yield of products per long ton of coal was: coke, 1593.4 lbs. (71.13 per cent.); tar, 75.7 lbs. (3.38 per cent.); ammonia 7.6 lbs. (0.34 per cent.); gas, 10,390 cu. ft. (16.43 per cent.). Of the gas 49.5 per cent. was of 14.7 candle-power, and 50.5 per cent. of 9 candle-power, only available as fuel gas. Carbon disulphide, hydrogen sulphide, gas liquor, and loss, amounted to 8.72 per cent. Numerous tables of analyses of the products and calculations of the heating value of the gas, coal, and coke are given. It is determined that 10.9 per cent. of the calorific value of the coal is consumed in the coking operation. It is shown that the production of illuminating and fuel gas and coke in these ovens rests on a sound theoretical and economic basis.

The Le Sueur Process for the Electrolytic Production of Sodium Hydroxide and Chlorine. By CHAS. L. PARSONS. *J. Am. Chem. Soc.*, **20**, 868–878.—A short history of the original process is given in which it is shown that some of the criticisms made by Lunge and others are unfounded. A detailed description of the process as carried on at Rumford Falls, Me., follows, in which it appears that the original apparatus has been greatly modified, although the essential features of the process are said to be unaltered. The chief difficulty has always been the diffusion of the caustic solution into the anode compartment. This is combatted by adding hydrochloric acid to the anode compartment, thus decomposing any hypochlorite formed. The amount of acid required is, by the table given, somewhat less than one-sixth of the total weight of salt decomposed. A sketch and a description of the improved cell are given, together with a discussion of the practical working and cost of the process.

Sulphuric Acid and the By-products from Iron Pyrites. By R. G. EWER. *J. Assoc. Eng. Soc.*, **21**, 160–171.—After a historical sketch of the sulphuric acid industry, tracing the improvements down to the present, the author describes a modern plant, showing a plan and details of a set of chambers of his own design. The process described shows the working of Spanish pyrites, with recovery of copper, silver, and gold and utilization of the iron oxides by blast-furnaces.

Turf Briquettes in Germany. By JOHN E. KEHL. *U. S. Consular Rep.*, **59**, 98.—The preparation of this new fuel is described briefly, and the success of the new venture predicted. The turf (peat) is carried directly from the bog to a breaker from which it goes to a steam dryer, and is thus obtained as a fine dry dust. This is heavily pressed to form briquettes, which furnish a cheap, clean, and easily handled fuel.

Refining Petroleum with Silicate of Sodium. By R. P. ROTHWELL. *Eng. Min. J.*, **66**, 338.—This article is in the main a condensed statement of the proposition of J. R. Michler to substitute sodium silicate solution for caustic soda in neutralizing the excess of acid left in heavy petroleum oils after the removal of the acid tar. The separation of the silicic acid is claimed to decolorize the oil, as well as to cause the sludge to settle quickly.

Colored Glazes. By S. Geysbeck. *Brick*, 9, 66.—This is a popular article in which is explained the causes of "crazing" and "shivering" in glazes for pottery. Methods of modifying the glazes to overcome these difficulties are given.

Analyses of Commercial Fertilizers. *Agr. Expt. Sta. Bull. Me., No.* 38; *N. J., No.* 124; *Ark., No.* 47; *Wis., No.* 66; *N. Y., No.* 129; *Md., No.* 52; *Miss., No.* 48; *W. Va., No.* 51; *Conn. 21st Ann. Rep., Pt. II; Cal. Ann. Rep., 1895–1897; Wis. 15th Ann. Rep.*; *W. Va. Special Bull., May 1, 1898.*

Crude Caustic Soda Sold in the Market as Caustic Potash. By Carl E. Smith. *Am. J. Pharm.*, 70, 392–398.—In the course of an investigation of the purity of commercial caustic potash, the author found five samples that were nothing else than caustic soda. It is supposed that they represent the supply furnished to grocers and other consumers who are not expected to test their purchases. The products were of good appearance, and might easily deceive their purchasers. Simple methods of testing crude alkali for sodium and potassium, and also quantitative methods for estimating soda and potash, caustic and carbonate, chlorides, sulphates, and silica in crude alkali, are given. The sensitiveness of sodium cobaltic nitrite as a test for potassium was also determined. A solution containing 0.2 per cent. of potassium hydrate showed turbidity in four minutes, but a weaker solution failed to react after many hours.

Sodium Aluminate as a Means for the Removal of Lime and Suspended Matter from Water for Use in Boilers. By Chas. F. Mabery and Edwin B. Baltzley. *J. Am. Chem. Soc.*, 21, 23–27.—The authors first studied a method of making sodium aluminate, which consisted in adding sodium hydroxide to aluminum sulphate solution of known strength. The solution of sodium aluminate so formed was then added in definite quantity to the water to be purified. The reactions involved in the precipitation are:

$$CaH_2(CO_3)_2+Al_2O_4Na_2+H_2O=CaCO_3+2Al(OH)_3+Na_2CO_3,$$

and $$CaSO_4+Na_2CO_3=CaCO_3+Na_2SO_4.$$

Seven different waters were tested by this method and also by sodium hydroxide alone, but in each case the latter removed only about one-half the quantity of lime that was thrown out by the aluminate. The precipitated alumina also removed suspended matter most completely.

Theory and Practice of Asphalt Mixtures. By A. W. Dow. *Am. Gas-Light J.*, 69, 862–863.—In testing asphalt for paving, it is often true that the investigator overlooks the physical laws involved, especially those relating to the attraction and adhesion of liquids to solids. Asphalt cement is properly a liquid, and the author showed by a simple experiment that one used in a Washington pavement flowed perceptibly at temperatures of 26°, 75°, and 140° F. A smooth block of asphalt was placed directly over a small hole in a board, and kept at these temperatures for some time. The amount of flow of the asphalt into the hole was measured. The hardness of a pavement mixture is largely dependent on the character of the sand used, very fine, sharp sand forming a much harder mass than coarse sand whose grains were rounded. With rounded grains it was found possible to make a very soft pavement mixture from asphalt which yielded a very hard mass with sharp sand.

Tanning Leather with the Aid of Electrolysis. By Chas. F. Mabery and K. L. Landgrebe. *Proc. Am. Assoc. Adv. Sci., 1898; Abstract Leather Manufacturer*, 9, 138–139.—Early attempts to apply electric currents to tanning date back to 1849 and 1883. The purpose of this investigation was to study the influence of the current on the chemical change and in hastening the process. The action of sodium sulphide as a depilatory was also studied. Samples of sheep, calf, and steer hides were treated in a bath made by mixing one liter of sodium sulphide solution containing 50 grams of the salt with four liters of lime water. After twenty minutes' agitation, the strongly alkaline bath reduced the hair to a pulp, which was easily scraped off, leaving the skin, after washing, ready for the tan. No bate was necessary, and the skin was soft and plump. This prepared skin was placed in a bark extract liquor between carbon plates and subjected to currents varying from three to six amperes, the potential difference varying from six to twelve volts, according to the strength of the tannin solution. A current of air was blown into the bath for agitation. A solution of 240 grams oak extract in three liters of water, with a current of 3.5 amperes (six volts potential), tanned the skin samples completely in 1.5 days. A similar experiment without electricity required six days to tan the skins. The current is supposed to assist in the intimate contact between the inner hide substance and oxygen, and also in precipitating coloring-matter, leaving only a clear tannin solution to permeate the skin. The determination of nitrogen in the hide substance shows that the hydrogen liberated exerts some action on the nitrogenous bodies, probably forming ammonia. The proportion of nitrogen in dry and fat-free hide from the same animals is constant; hence this enables [illegible] substance to be [illegible] sheep and calf [illegible] showing [illegible]

[illegible]

[illegible]

[illegible] Derivatives of the [illegible] B. Mendel. [illegible]—In [illegible] described the re- [illegible] clear- [illegible] made as to [illegible] on [illegible] con- [illegible] propeptone [illegible]. The [illegible] of the [illegible] used and to a [illegible] was formed [illegible] was dried at [illegible] trypsin on [illegible] of the [illegible] by ammo-

[illegible] upon the Germination of [illegible] *Gazette*, 26, [illegible] solu- [illegible] fungus [illegible] in salt [illegible] van Tieghem [illegible] chloride had [illegible] was re- [illegible] fungi differ [illegible] resistance even [illegible] and Cu. and [illegible] while the [illegible] the results were [illegible]

[illegible] Plasmolyzing Agents. [illegible]—The [illegible] physiological [illegible] agents, cane- [illegible]. He is of the opinion that all sodium and potassium salts injure spirogyra through their chemical and not their osmotic properties.

The Proteids of Cream. By E. F. Ladd. *J. Am. Chem. Soc.*, 20, 858–860.—The proteids of cream were divided into four groups, casein, albumen, albumoses, and peptones; the first group being precipitated by saturated alum solution, the second by boiling, the third by zinc sulphate, and the fourth by 80 per cent. alcohol. The analyses made show that no marked change took place in the proteids during the ripening of the cream.

Composition of Ohio Wines. By Albert W. Smith and Norman Parks. *J. Am. Chem. Soc.*, 20, 878–882.—The authors have analyzed twelve samples of wine of known purity and a number purchased in the open market. They find that in general their results do not differ much from published analyses of pure European wines from similar grapes, except in the percentages of glycerol and of ash, which are noticeably lower.

The Normal Chlorine of the Water Supplies of Jamaica. By Ellen H. Richards and Arthur T. Hopkins. *Tech. Quart.*, 11, 227–240.—From the results of analysis of seventy-six samples the authors have drawn a chart of the normal chlorine for the island of Jamaica giving the isochlors for 2.0, 1.0, 0.9, 0.8, 0.5 and 0.3 parts per hundred thousand. It has been found in general that the isochlors follow the coast line, being modified, however, by the excessive precipitation and evaporation which causes varying "dilution and concentration of chlorine." The fact that the interior of the island is but sparsely inhabited has made it possible to prepare a chart which is probably fairly accurate even though so few samples were analyzed.

Concentrated Feed Stuffs. By Joseph B. Lindsey. *Hatch Expt. Sta. Mass. Agr. Coll., Bull.* 56, 1–24. **Feeds Rich in Protein.** By Edward B. Voorhees. *N. J. Agr. Expt. Sta., Bull.* 131, 1–14.—These two bulletins contain the results of determinations of water, protein, and fat in various commercial feeding materials, such as cottonseed meal, gluten meal, wheat middlings, etc.

Commercial Fertilizers. *N. Y. Agr. Expt. Sta. Bull.* 145, 49–149; *Me. Agr. Expt. Sta. Bull.* 45, 1–24; *N. J. Agr. Expt. Sta. Bull.* 132, 1–61.

Baking Powders. *N. C. Agr. Expt. Sta. Bull.* 155, 51–56.

The Oil of Corn. By C. G. Hopkins. *J. Am. Chem. Soc.*, 20, 948–961.—As the result of a quite thorough examination of corn oil obtained from various sources the author considers its percentage composition to be as follows: cholesterol, 1.37; lecithin, 1.49; stearin(?), 3.66; olein, 44.85; linolin, 48.19; total, 99.56.

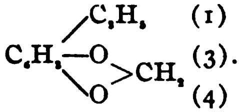
Crystals of Sodium Chloride in Fluid Extract of Yerba Reuma and a Proximate Analysis of this Plant. BY LYMAN F. KEBLER. *Am. J. Pharm.*, 71, 23–25.—The discovery of cubical crystals resembling salt in a fluid extract of Yerba Reuma about fifteen years old led the author to make a proximate analysis of the plant, following Dragendorff's scheme in the main. The most striking result obtained was the high percentage of ash and chlorides, amounting in one case to 34.12 per cent. of ash and 17.42 per cent. of chlorides calculated to sodium chloride.

A Report of Progress of Investigations in the Chemistry of Wheat. BY G. L. TELLER. *Ark. Agr. Expt. Sta. Bull.* 53, 53–80.—In the course of this investigation analyses have been made of wheat gathered on each of forty-two consecutive days from the time of the setting up of the grain. The author finds a marked change in the relative proportion of the nitrogenous constituents at different periods of growth. The gliadin was found to increase largely from the earliest cutting until ripening, while the glutenin and amides decreased. The proportion of ash, amides, fats, fiber, dextrins and pentosans in the dry matter of the grain gradually decreased from the earliest stages. A more or less rapid decrease was also noted in the proportion of sucrose and of reducing sugar, while the proportion of starch rapidly increased up to a week before ripening. The proportion of total proteids in the dry matter steadily decreased up to a week before ripening and then gradually increased. The nitrogen compounds in the ripe grain were present in about the following proportions: amides, 1; edestin and leucosin, 3.5; glutenin, 10; gliadin, 16. The author also brings forward experimental evidence that the proteid designated "Proteose" by Osborne and Voorhees (*Am. Chem. J.*, 15, 468) is gliadin.

The Chemical Composition of the Carcasses of Pigs. BY H. W. WILEY AND OTHERS. *U. S. Dept. Agr., Div. of Chem., Bull.* 53, 1–80.—This bulletin contains the results of analyses of the carcasses of eight breeds of American pigs, which had been cut up according to the prevailing method for the American market. In the samples, which were prepared with great care, the following determinations were made: Water, fat, ash, total nitrogen, nitrogen insoluble in hot water, nitrogen soluble in hot water but precipitated by bromine, and lecithin. The analytical results are given in a set of fifty-six tables, which are followed by a discussion. The bulletin also contains an abstract of the literature relating to the separation of flesh bases from other nitrogenous bodies.

An Active Principle in Millet Hay. By E. F. Ladd. *Am. Chem. J.*, 20, 861–866.—The purpose of this work was to determine whether millet hay contained an extractive principle capable of producing the physiological disturbances that have followed the feeding of it to horses. The ground millet was extracted with petroleum ether and with ordinary ether without obtaining any unusual active principle. Tests made on the aqueous solution of the alcoholic extract, however, indicated the presence of some alkaloid or glucoside. From this aqueous solution, acidified with sulphuric acid, benzine extracted a light-yellow oily liquid, which, in some of its properties, resembled the glucoside *daphnin*, $C_{31}H_{34}O_{19}$, but differed from it in some respects. The physiological effect of this substance upon animals was found to be similar to that of the millet, but more marked.

The Chemistry of Sassafras. By Clemens Kleber. *Am. J. Pharm.*, 71, 27–32.—The chemistry of sassafras consists principally of the chemistry of its essential oils. The principal ingredient of the oil obtained from the bark of the root, which is what is ordinarily known as oil of sassafras, is safrol. This is the methylene ether of an allylpyrocatechin :



$$\begin{array}{lll} & \diagup C_3H_5 & (1) \\ C_6H_3 & -O{>}CH_2 & (3). \\ & \diagdown O & (4) \end{array}$$

When oxidized this yields piperonal, and by further oxidation piperonylic acid. When safrol is boiled with alcoholic potash its allyl group is transformed into the isomeric propenyl group ($CH_3.CH : CH.$) thus forming isosafrol. The other constituents, present in much smaller quantity, are pinene, phellandrene, camphor, eugenol and cadinene (?). The oil of sassafras-leaves contains also considerable amounts of citral and geraniol as well as linalool, these last two alcohols being present also in the form of their acetic and valerianic esters. In the highest boiling, part is also a paraffin-like substance melting at 58° C.

Analysis of the Root of Hydrangea Paniculata, Variety Grandiflora. By August G. Luebert. *Am. J. Pharm.*, 70, 550–552.—The author has made a proximate analysis of the root of this plant, following Dragendorff's method of analysis. From the alcoholic and ethereal extracts was obtained a crystalline body melting at 178° C. The reactions of this substance indicate that it is not the *hydrangin* found in the closely allied species, *Hydrangea arborescens*, and the author proposes for it the name *parahydrangin*. The amounts of other constituents contained in the root are also given.

Note on the Inversion of Cane Sugar in Official Syrups. By Louis Kahlenberg. *Pharm. Rev.*, 17, 10–12.—A critical review of an article on this subject by F. W. Haussman (*Am. J. Pharm.*, 70, 585).

Notes on Two Oils Containing Pulegone. Reported by Edward Kremers. *Pharm. Rev.*, 16, 412-417. **I. Mentha Canadensis L.** By Florence M. Gage.—The oil obtained by distillation of the fresh herb was examined. Its sp. gr. at 20° was 0.935, and it rotated the plane of polarized light 16°11′ to the right. The characteristic odor for carvacrol was obtained by Flückiger's reaction. By adding amyl nitrite and a trace of hydrochloric acid to the petroleum ether solution of the oil, crystals of nitrosopulegone melting at 79° were obtained. Crystals of pulegone oxime were also obtained corresponding to those from pennyroyal oil. **II. Pycnanthemum Lanceolatum Pursh.** By F. W. Alden.—The author has distilled both green and dry samples of the herb and in each case obtained a test for carvacrol. Using petroleum ether as a solvent, crystalline pulegone oxime was obtained without difficulty according to the method of Beckmann and Pleissner by the action of hydroxylamine hydrochloride and sodium bicarbonate on the oil. The crystals melted at 151°, and after solidification and cooling, the oxime melted at 117°–118°.

G. W. ROLFE, REVIEWER.

Glycollic Acid: One of the Acids of Sugar Cane. By Edmund C. Shorey. *J. Am. Chem. Soc.*, 21, 45–50.—The author has obtained glycollic acid from Hawaiian cane-juice in quantities amounting to from seventy-five to eighty per cent. of the total acidity of the juice. He carefully differentiates this acid from malic and aconitic acids, and shows that his results are characteristic of glycollic acid alone. The possible bearing on sugar manufacture of the presence of this acid is also considered. The author believes it may be responsible for much of the caramel formed in molasses products as well as for the foaming of molasses massecuites in cars. The relation of the subject to the chemistry of the life processes of the growing cane is most interesting.

Light a Factor in Sugar Production. By H. A. Weber. *J. Am. Chem. Soc.*, 21, 53–59.—Much evidence, taken from the history of beet and sorghum culture in this country, has been collected by the author to demonstrate that the sugar content of the plant is dependent on the amount of direct sunlight received; hence, this should be an important consideration in deciding upon the most favorable climatic conditions for beet culture.

[CONTRIBUTION FROM THE MASSACHUSETTS INSTITUTE OF TECHNOLOGY.]

REVIEW OF AMERICAN CHEMICAL RESEARCH.

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ARTHUR A. NOYES, Editor; HENRY P. TALBOT, Associate Editor.
REVIEWERS: Analytical Chemistry, H. P. Talbot and W. H. Walker; Biological Chemistry, A. G. Woodman; Carbohydrates, G. W. Rolfe; General Chemistry, A. A. Noyes; Geological and Mineralogical Chemistry, W. O. Crosby; Inorganic Chemistry, Henry Fay; Metallurgical Chemistry and Assaying, H. O. Hofman; Organic Chemistry, J. F. Norris; Physical Chemistry, H. M. Goodwin; Sanitary Chemistry, E. H. Richards; Technical Chemistry, A. H. Gill and F. H. Thorp.

INORGANIC CHEMISTRY.

HENRY FAY, REVIEWER.

Presidential Address. BY WOLCOTT GIBBS. *Proc. Am. Assoc. Advancement Sci.*, 1898, 1–16. *Science*, 8, 233–243.—The author attempts to work out the theoretical relations existing between the complex derivatives of molybdic and tungstic acids with the acids of silicon and phosphorus.

On Some Relations among the Hydrates of the Metallic Nitrates. BY J. H. KASTLE. *Am. Chem. J.*, 20, 814–819.—The author has found that practically all of the salts of nitric acid may be referred to one of the hypothetical nitric acids, and that the nitrates can be grouped under five general classes. The first class, which includes all of the anhydrous nitrates, is regarded as an addition-product of the anhydride of nitric acid and the metallic oxide, $M^I_2O+N_2O_5 = 2M^INO_3$. The second class includes a few nitrates, $HgNO_3.H_2O$ and $Th(NO_3)_4.4H_2O$, which are formed by the addition of ordinary nitric acid to a metallic base $M(OH)+HNO_3=MNO_3.H_2O$. To the third class belong a large number of nitrates of the bivalent and trivalent metals which are addition products of ortho-nitric acid and the metallic base derived as follows: $M^{II}(OH)_2+2H_3NO_4=M^{III}(NO_3)_2.4H_2O$; $M^{III}(OH)_3+3H_3NO_4=M^{III}(NO_3)_3.6H_2O$. Examples of this class are $Ca(NO_3)_2.4H_2O$, $Fe(NO_3)_3.6H_2O$, and a large number of double nitrates of which $2Ce(NO_3)_3.3Co(NO_3)_2.24H_2O$ is a type. The fourth class is formed by the addition of a base to the acid H_3NO_5, as $M^{II}(OH)_2+2H_3NO_5=M^{II}(NO_3)_2.6H_2O$, $M^{III}(OH)_3+3H_3NO_5=M^{III}(NO_3)_3.9H_2O$, and $M^{IV}(OH)_{IV}+4H_3NO_5=M^{IV}(NO_3)_4.12H_2O$. By the addition of pyronitric acid to a metallic base the fifth class is formed : $M\ (OH)_2 + H_4N_2O_7 = M^{II}(NO_3)_2.3H_2O$ of which $Cu(NO_3)_2.3H_2O$ is an example. Including a number of cases of doubtful composition, 75 per cent. of all the normal nitrates described fall under one of these five classes. Most of the basic nitrates may also be classed under these headings as salts of some of the hypothetical nitric acids.

Liquid Ammonia as a Solvent. By E. C. Franklin and C. A. Kraus. *Am. Chem. J.*, 20, 820–836.—The authors have extended the work of Gore, Weyl, and Seeley on the solubility of various inorganic and organic substances in ammonia. Liquid ammonia was drawn off into a vacuum-jacketed tube and the substance to be tested was introduced into this tube in small quantity at a time and in case the substance was a solid, in the form of fine powder. Where there was any doubt about the solubility a measurement of the electrical conductivity was made. Tables are given which show the solubility of 157 inorganic salts and 250 organic substances.

Metathetic Reactions between Certain Salts in Solution in Liquid Ammonia. By E. C. Franklin and C. A. Kraus. *Am. Chem. J.*, 21, 1–8.—On account of the close relationship between liquid ammonia and water in solvent power, and in the power of dissociating many salts, it was supposed that metathetic reactions would take place in liquid ammonia as in water. This has been shown to be true. Sixteen nitrates were used to furnish the metallic ions ; and the sulphide, chloride, bromide, iodide, chromate, and borate of ammonia were used as precipitants. The tests were made by bringing the nitrates and the precipitants together in small vacuum-jacketed tubes and observing whether or not a precipitate was formed. Using ammonium chloride as precipitant no precipitates were produced in solutions of sodium and mercuric nitrates ; and from solutions of lithium, potassium, lead, silver, and copper, precipitates were produced only in concentrated solutions ; other nitrates gave precipitates at once. With ammonium bromide the results were the same except that here in addition potassium gave no precipitate and the other precipitations took place more slowly. Ammonium iodide produced precipitations only in solutions of strontium and barium salts. All the metals tested, with the exception of the alkalies, precipitated with ammonium sulphide. Judging from the color only a few of these substances were identical with the sulphides produced in water solution. The magnesium precipitate was found to be a double salt, $2MgS.(NH_4)_2S.xNH_3$, which evolved ammonia and hydrogen sulphide in the air. Ammonium chromate produces precipitates with all metals tested except lithium and sodium ; ammonium borate acts similarly with the exception that the potassium salt is soluble.

On the Solubility of Argentic Bromide and Chloride in Solutions of Sodic Thiosulphate. By Theodore William Richards and Henry Burnell Faber. *Am. Chem. J.*, 21, 167–172.—The authors have examined the solubility of silver bromide and chloride in sodium thiosulphate by agitating an excess of the pure silver salts with solutions of varying strength of the thiosulphate. After thorough agitation 5 cc. portions were drawn off and analyzed for silver. With increasing strength of the thiosulphate solutions the quantity of silver salt going into solution increased more rapidly than the increase in the quantity of thiosulphate used. The molecular ratio of the sodium thiosulphate to the dissolved salts at 35° C. for 200 grams of the crystallized salt to the liter of water was 1 : 0.78 for silver chloride and 1 : 0.52 for silver bromide. Evidence for the existence of a complex ion in such solutions was obtained by observing the change in the freezing-point; it was found that by the addition of silver bromide the freezing-point was *raised* indicating the formation of a complex salt.

A New Gas. By Charles F. Brush. *J. Am. Chem. Soc.*, 20, 899–912.—During an investigation of the heat conductivity of various gases at extremely low pressures, it was found that gases were evolved from the glass on heating, which were only partly reabsorbed on cooling. Supposing the gas to come from the surface, some powdered glass was placed in the tube, and from this the gas seemed to be more freely evolved. On exposure to the air more of the gas was absorbed by the glass. On slight diminution of pressure the gas begins to come off, and the amount rapidly increases with the diminishing pressure. It is readily absorbed by soda-lime and phosphorus pentoxide. The heat conductivity at a pressure of 0.96 millionths of an atmosphere was found to be twenty times as great as that of hydrogen, and that of the pure gas would be 100 times that of hydrogen. If the inference is correct that the heat conductivity and the molecular velocity of gases are directly related, then the molecular velocity of the new gas is also one hundred times that of hydrogen. From this value of the molecular velocity, the density was found to be 0.0001, and the molecular weight, 0.0002. The author suggests that at anything like this molecular velocity, it would be quite impossible for a gas to remain in the atmosphere *unless the space above also contained it*, and therefore that the gas must fill all celestial space. On this assumption he has named the gas "[illegible]herion," and suggests that it may have some of the properties of the ether of the physicist.—Various investigators, notably Crookes, have recently claimed that all the phenomena described by Brush can be explained by the presence of a small quantity of water vapor in his apparatus.

Commercial Iron Silicides with a High Percentage of Silicon: Their Properties, Manufacture, and Uses. By G. de Chalmot. *J. Am. Chem. Soc.*, **21**, 59–66.—The author has produced in the electric furnace iron silicides containing from twenty-five to fifty per cent. of silicon and probably consisting of the two compounds $FeSi_2$ and Fe_2Si_5. These silicides are crystalline, white or gray, hard and brittle, unalterable in the air, and can be cast well with sharp outlines and corners. These alloys are recommended for castings, on account of the smooth finish and high luster they are capable of taking; for anodes for electrolysis in aqueous baths; and for abrasives. Their manufacture is carried out by heating iron ore, river sand, and coke, in a special form of electric furnace.

The Preparation of Zirconium Nitrides. By J. Merritt Matthews. *J. Am. Chem. Soc.*, **20**, 843–846.—The compound $ZrCl_4.8NH_3$ heated in a current of nitrogen decomposes and leaves as a gray residue the nitride Zr_3N_8. By heating zirconium tetrachloride in ammonia gas there is decomposition with the formation of the nitride Zr_2N_3.

Method of Preparing a Strictly Neutral Ammonium Citrate Solution. By A. D. Cook. *J. Am. Chem. Soc.*, **20**, 585–586.—The author recommends stirring the citric acid solution after adding ammonia, the heat of neutralization being sufficient to drive off the excess of ammonia.

On the Segregation of Carbon in a Piece of Boiler Plate. By Henry Fay and Henry P. Talbot. *J. Am. Chem. Soc.*, **20**, 614–617.—The authors have examined a piece of boiler-plate steel which, after having been twice annealed, cracked on flanging. On polishing and etching the surface, it was found that the steel was highly crystalline, and that the crystalline layer extended only part way into the plate on either side. Microscopical examination showed the carbon to be much segregated, and analysis of the borings taken from different parts of the plate varied from 0.03 to 0.156 per cent. of carbon. The probable cause of the brittleness was due to the annealing which was done at a temperature, 600°–750° C., at which granulation of mild steel takes place, as has been shown by the experiments of Stead.

ORGANIC CHEMISTRY.

J. F. Norris, Reviewer.

On Some Double Halides of Mercury. By J. N. Swan. *Am. Chem. J.*, **20**, 613–633.—The double chlorides of mercury with aniline and the toluidines were prepared and studied. Aniline, *o*-toluidine, and *p*-toluidine gave salts of the composition, $2HgCl_2.BHCl$, $HgCl_2.BHCl$, and $HgCl_2.2BHCl$ where B represents the base. With *p*-toluidine but one salt was obtained which had the formula $HgCl_2.BHCl$. A mixed double halide of *o*-toluidine, $HgBr_2.BHCl$ and the following inorganic salts were also prepared : $3HgCl_2.MgCl_2.6H_2O$, $3HgCl_2.SrCl_2.XH_2O$, $3HgCl_2.BaCl_2.8H_2O$.

The Double Halides of Tin with Aniline and the Toluidines. By ROBERT L. SLAGLE. *Am. Chem. J.*, **20**, 633–646.—A systematic search for the possible double chlorides of tin with aniline and the toluidines led to the preparation of the following salts which are fully described: With aniline, $SnCl_2.BHCl.H_2O$, $SnCl_2.2BHCl$, $SnCl_4.2BHCl$, and $SnCl_4.2BHCl.3H_2O$; with *o*-toluidine, $SnCl_2.BHCl.\frac{1}{2}H_2O$, $SnCl_4.3BHCl.2H_2O$; with *m*-toluidine, $SnCl_2.BHCl.\frac{1}{2}H_2O$, $SnCl_4.2BHCl.H_2O$; and with *p*-toluidine $SnCl_2.BHCl.\frac{1}{2}H_2O$, $SnCl_2.2BHCl$, $SnCl_4.2BHCl.H_2O$.

On Double Halides of Zinc with Aniline and the Toluidines. By DANIEL BASE. *Am. Chem. J.*, **20**, 646–664.—The author gives a complete list of all the double halides of zinc with organic and inorganic bases which have been described. A study of the double chlorides of zinc and ammonium showed that but two salts are possible although eight have been described. These salts have the composition $ZnCl_2.2NH_4Cl$ and $ZnCl_2.3NH_4Cl$. A careful study of the possible double chlorides and bromides of zinc with aniline and the toluidines resulted in the formation of the following salts: With aniline, $ZnCl_2.2BHCl.H_2O$, $ZnCl_2.3BHCl.2H_2O$, $ZnBr_2.2BHBr.H_2O$; with *o*-toluidine, $ZnCl_2.2BHCl.2H_2O$, $ZnBr_2.2BHBr.H_2O$; with *m*-toluidine, $ZnCl_2.2BHCl$, $ZnCl_2.3BHCl$, $ZnBr_2.2BHBr.2H_2O$, $ZnBr_2.3BHBr$; and with *p*-toluidine, $ZnCl_2.2BHCl$, $ZnCl_2.3BHCl$, $ZnBr_2.2BHBr.H_2O$.

Sulphonation of the Paraffins. By R. A. WORSTALL. *Am. Chem. J.*, **20**, 664–675.—The normal paraffins hexane, heptane, and octane are readily sulphonated when they are heated with fuming sulphuric acid in an open flask with a return-condenser. A yield of 30 to 40 per cent. of the monosulphonic acid was obtained when successive portions of the acid were used and the temperature was kept at the boiling point of the hydrocarbon. When the vapors of sulphur trioxide are passed through the boiling hydrocarbons disulphonic acids are produced. The yield of the latter was about 40 per cent. of the theoretical. The mono- and disulphonic acids are thick sirups which form barium and lead salts, which are very soluble in water and deliquesce rapidly.

The Formation of Hydrazides by the Action of Phenylhydrazine upon Organic Acids in the Cold. By VIRGIL L. LEIGHTON.

Am. Chem. J., 20, 676–679.—Acetylphenylhydrazide was formed when a solution of phenylhydrazine acetate in acetic acid was allowed to stand four days. The formation of hydrazides from the phenylhydrazine salts of acids dissolved in the smallest quantity of the respective acid was shown to be a general reaction by the preparation of the hydrazides of formic, acetic, propionic, isobutyric, isohexylic, and heptylic acids.

Aliphatic Sulphonic Acids: II. Ethylenesulphonic Acids. BY ELMER P. KOHLER. *Am. Chem. J.*, 20, 680–695.—Ethylenesulphonic acid was prepared by decomposing 1,2-ethanedisulphone chloride with boiling water, by distilling 1,2-bromethanesulphone chloride under an increased pressure, and by heating the potassium salt of the acetic ester of isethionic acid at 185°. The acid forms well-crystallized ammonium, potassium, sodium, barium, and lead salts. The chloride of the acid prepared by treating the potassium salt suspended in chloroform with phosphorus pentachloride can be distilled under diminished pressure. Ethylenesulphonic acid is oxidized readily, the products being carbon dioxide, sulphuric acid, and water. Reduction is effected with difficulty: sodium amalgam in alkaline solution and zinc in acid solution are without effect. When the acid is heated with phosphorus and iodine, ethanesulphonic acid is formed. Ethylenesulphonic acid combines readily with water, especially in the presence of alkali, forming isethionic acid. When heated at 130° with hydrochloric and hydrobromic acids, addition-products are formed in which the halogen atoms are in the 2-position. With bromine, 1,1-bromethylenesulphonic acid is produced, the substitution being rapid and complete even at 0°.

The Ethers of Toluquinoneoxime and their Bearing on the Space Isomerism of Nitrogen. BY JOHN L. BRIDGE AND WM. CONGER MORGAN. *Am. Chem. J.*, 20, 761-776.—Toluquinone-*o*-oxime obtained by the action of nitrous acid on *m*-cresol forms well-characterized acetyl, benzoyl, and methyl ethers. The benzoyl ether of toluquinone-*m*-oxime, prepared in the same way from *o*-cresol, was shown to consist of a mixture of two isomeric substances, which were separated by fractional crystallization. The same ethers were obtained from the oxime formed by the action of hydroxylamine on toluquinone, and as no toluquinone-*o*-oxime was formed under these circumstances it seems highly probable that the isomerism is due to the space relation of the oxime group. Isomeric acetyl and methyl derivatives of toluquinone-*m*-oxime were also obtained. The compounds mentioned and a number of their bromine derivatives are described fully.

Camphoric Acid. By William A. Noyes. *Am. Chem. J.*, **20**, 789–814.—By an error in his thermometer the author working with E. B. Harris, was led to think that the oxime of a ketone prepared from cis-campholytic acid (Harris, *this Rev.*, 3, 12), and the oxime of dimethyl-(1,3)-cyclohexanone (2) made by Kipping (*J. Chem. Soc.*, 67, 357) were identical. If the oximes were the same cis-campholytic acid would have the structure of Δ^1-tetrahydroxylic acid, $C_6H_7(CH_3)_2(1,3)COOH(2)$ and accordingly the synthesis of the latter acid was attempted. Although the preparation of the xylic acid will probably throw no light on the structure of cis-campholytic acid, the synthesis, which has been carried as far as the preparation of the neighboring xylic acid, is described, as a large number of new compounds has been prepared. The nitrile of the acid was obtained by the diazo reaction from 2-amino-*m*-xylene, but its saponification could not be effected. The xylidine required was obtained from commercial xylidine, in which it is present to the extent of about 2 per cent. An attempt was next made to prepare the xylic acid from dimethylcyclohexanone. In the preparation of the necessary dimethylpimelic acid, the dimethylpentanetetracarboxylic acid obtained as an intermediate product was isolated and found to have properties different from those which had been assigned to it. Dimethylcyclohexanone was prepared from dimethylpimelic acid, but the attempts to convert it into the hexahydroxylic acid through the cyanhydrin or cyanide were unsuccessful. The next method of preparation studied was the conversion of ethylidenediacetacetic ester into a cyclic compound by distillation under diminished pressure with chloroform and subsequent treatment with bromine (Knoevenagel, *Ann. Chem.* (Liebig), **281**, 121). As only dimethyl-(1,3)-phenol-5-methylic-(2) acid, and its ethyl ester were obtained the method was abandoned. Unsuccessful attempts to prepare the xylic from acetobromxylene and acetoiodoxylene led to the preparation of 4-chlor-2-brom-*m*-xylene, 4-aceto-5-brom-1,3-xylene, bromxylic acid, $C_6H_2(CH_3)_2(1,3)COOH(4)Br(5)$, acetoiodoxylene, $C_6H_2(CH_3)_2(1,3)COCH_3(4)I(5)$, iodoxylylglyoxalic acid, $C_6H_2(CH_3)_2$, CO.COOH, iodomethylterephthalic acid, $C_6H_2CH_3(1)(COOH)_2(2,3)I(5)$ and two iodoxylic acids. The preparation of the neighboring xylic acid was finally effected from acetomesitylene. Improved directions for the preparation of mesitylene from acetone are given by which the yield is greatly increased. The mesitylene was converted into the acetyl derivative which, when oxidized, gave a mixture of about equal parts of 2,6-dimethyl terephthalic acid and dimethylphthalic acid. The acid ester of the former acid was converted into the amide, which was changed into an amine by means of sodium hypobromite. The amido group was replaced by iodine, which in turn was removed by zinc dust and ammonia. The resulting acid was the neighboring xylic acid sought. The author proposes to reduce this acid.

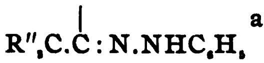
On the Non-existence of Four Methenylphenylparatolyl Amidines. By H. L. Wheeler and T. B. Johnson. *Am. Chem. J.*, 20, 853–861.—The authors have carefully studied the four methenylphenylparatolyl amidines prepared according to Zwingenberger and Walther (*J. prakt. Chem.*, 57, 209), and have found that the substances are not pure compounds. By fractional crystallization the amidines were shown to consist of two or more substances. By crystallizing together mixtures of the constituents found, crystals were obtained which had the properties of the amidines described and which formed double platinum salts and picrates agreeing closely in melting-points with those given by Zwingenberger and Walther. The fact that but one methenylphenylparatolyl amidine exists destroys the conclusions of Walther (*J. prakt. Chem.*, 55, 43; 57, 229) as to the structure of the anilides. Methenylmethylphenylamide-phenylimidine, $C_6H_5(CH_3)N—CH=NC_6H_5$, was prepared by mixing methylaniline with methylisoformanilide, by adding a mixture of methylaniline and formanilide to an excess of phosphorus trichloride, and by heating methenyldiphenylamidine with an excess of methyl iodide. The compound is a colorless oil, which forms a hydrochloride and a double chloride with gold.

Creatin and Its Separation. By E. F. Ladd and P. B. Bottenfield. *Am. Chem. J.*, 20, 869–870.—The amount of creatin in ox flesh was determined by the methods of Neubauer, Stradler, and Liebig and was found to be 0.250, 0.234, and 0.215 respectively. The same methods of analysis applied to the flesh of a dog gave 0.242, 0.230, and 0.218 per cent. The authors consider the high results obtained by Neubauer's method the most accurate.

A Double Citrate of Zirconium and Ammonium. By S. H. Harris. *Am. Chem. J.*, 20, 871–872.—By adding an aqueous solution of ammonium citrate to a solution of zirconium chloride a double salt of the composition $Zr_2(C_6H_5O_7)(NH_4)_3$ was formed as a curdy white precipitate which was very deliquescent when dried.

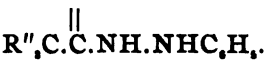
On the Constitution of the Phenylhydrazones. By Paul C. Freer. *Am. Chem. J.*, 21, 14–64.—Two possible constitutions can be assigned to the compounds of phenylhydrazine with ketones and aldehydes:

(1)



$$R'RHC—C(:N.NHC_6H_5).CR''_3$$

and (2)



$$RR'C=C(.NH.NHC_6H_5).CR''_3.$$

When phenylhydrazine reacts with an aldehyde or a ketone there is, in all probability, a direct addition-product formed, which immediately loses water and passes into the hydrazone. This elimination of water could take place in two ways and would yield either a true hydrazone (formula 1) or a hydrazo compound (formula 2). That such addition-products are formed was shown by the fact that ethereal solutions of aldehyde and methylethyl ketone, when cooled to —20° and mixed with phenylhydrazine, gave precipitates which dissolved and changed into hydrazones. The phenylhydrazones can be divided into two classes: those which are readily oxidized in the air and change to non-crystallizable tars with the evolution of gas, such as the phenylhydrazones of acetone, other aliphatic ketones, and acetophenone; and those which are perfectly stable or do not yield oxidation-products, such as the derivatives of aceto-acetic ester, pyruvic acid, and benzophenone. It is concluded that the hydrazones of the first class are probably hydrazo compounds and have the structure represented by formula (2) while those of the second class are true hydrazones (formula 1). This conclusion is justified by the fact that acetone-*p*-bromphenylhydrazone, when carefully subjected to the action of the air, is quantitatively changed to a red explosive azo compound, which is reduced by sodium amalgam to the original hydrazone. The azo compound exhibited the characteristic properties of true azo bodies, forming a crystalline perbromide, which decomposed in the manner typical of such compounds. Since the formation of an azo compound from a true hydrazone by oxidation seems highly improbable, formula (2) must be assigned to acetone-*p*-bromphenylhydrazone. The phenylhydrazone of acetophenone formed derivatives analogous to those described above. The two classes of hydrazones show a marked difference in behavior with benzoyl chloride. Acetonephenylhydrazone, which is readily oxidized to an azo compound, and has the hydrazo structure, readily reacts with benzoyl chloride and forms a product containing two benzoyl radicles, whereas benzophenone, having the hydrazone structure, reacts with difficulty and the resulting compound contains but one benzoyl group. This method of deciding structure can not be applied to the large number of hydrazones which do not react with benzoyl chloride. If the phenylhydrazones are formed by the elimination of water from an addition-product of the ketone and phenylhydrazine, it is possible that one ketone might yield two isomeric derivatives represented by the above formulas. Smith and Ransom (*Am. Chem. J.*, 16, 108), have proved the existence of two benzoïnphenylhydrazones and considered them to be geometrical isomers. The author's method of study shows that the two substances have different structures. One is readily oxidized to an azo compound by nitrogen trioxide with which it forms a red crystalline addition-product, which in turn forms a characteristic perbromide. The other, when treated in the same way, gives a white tetrazone. β-Benzoïnphenylhydrazone is converted into an isomeric substance by benzoyl chloride. The two acetaldehydrazones were studied in the same way but the results were not conclusive, since the two compounds change from one form to the other with great readiness. Doubt is thrown upon the structure of the compound prepared by oxidizing acetoaceticesterphenylhydrazone with mercuric oxide. The facts that the compound does not give a perbromide, that it is not reduced to the original hydrazone by sodium amalgam, and that it can be heated above its melting-point without decomposition, show that it is not benzene-azo-β-oxycrotonic ester. Chloraldehyde hydrate and phenylhydrazine yielded a substance of the structure

$$C_6H_5.NH.NH.CH_2.CH : N.NH.C_6H_5.$$

Note on the Action of Liquid Hydriodic Acid on Ethyl Ether. BY F. G. COTTRELL AND ROY RAVONE ROGERS. *Am. Chem. J.*, 21, 64–67.—When ether and liquid hydriodic acid were mixed a vigorous reaction took place and water and ethyl iodide were formed. By conducting the experiment in a specially designed piece of apparatus, an almost quantitative yield of ethyl iodide was obtained. This is noteworthy since Silva has shown (*Compt. rend.*, 81, 323) that with gaseous hydriodic acid alcohol was also formed.

Certain Alkaloidal Periodides and the Volumetric Estimation of Alkaloids as Higher Periodides. BY A. B. PRESCOTT AND H. M. GORDIN. *J. Am. Chem. Soc.*, 20, 706–728.—By pouring a solution of atropine in dilute hydrochloric acid into a large excess of Wagner's reagent a periodide is precipitated containing nine iodine atoms. Under similar conditions strychnine, brucine, and aconitine give periodides containing seven atoms of iodine, while with morphine the precipitate contains but four atoms of iodine. The authors show that the formation of these perhalides is quantitative, and describe the volumetric estimation of the above alkaloids based on this reaction. Two double iodides of atropine and mercury are also described.

On Tetraphenylmethane. BY M. GOMBERG. *J. Am. Chem. Soc.*, 20, 773–780.—Improved directions for the preparation of tetraphenylmethane from triphenylmethanehydrazobenzene are given. A molecular weight determination of the hydrocarbon and an analysis of the tetranitro-derivative furnish further evidence for the composition which has been assigned it. This is also shown by the fact that the nitro-derivative does not form a sodium salt, whereas dinitrodiphenylmethane and trinitrotriphenylmethane give highly colored sodium compounds.

Hydrazo- and Azo-derivatives of Triphenylmethane. By M. Gomberg and A. Campbell. *J. Am. Chem. Soc.*, **20**, 780–790.—Well-crystallized hydrazo-compounds were formed by treating triphenylbrommethane with a large number of hydrazines. They oxidize in the air and form salts with dry hydrochloric, oxalic, picric, and other acids. The hydrazo-compounds are readily oxidized by amyl nitrite to azo-derivatives, which give off their nitrogen quantitatively when heated.

A Periodide of Triphenylbrommethane. By M. Gomberg. *J. Am. Chem. Soc.*, 790–793.—Triphenylbrommethane unites with iodine in benzene solution and forms a periodide of the composition $(C_6H_5)_3CBr.I_4$, which crystallizes in hollow hexagonal crystals.

Perhalides of Quinoline. By P. F. Trowbridge. *J. Am. Chem. Soc.*, **21**, 66–72.—A large number of perhalides of quinoline containing one, two, and four added halogen atoms are described. Halogen addition-products of the compounds formed by the union of quinoline and methyl chloride, bromide, and iodide were also prepared.

Analysis of Aqueous Alcohol. By Chester B. Curtis. *J. Phys. Chem.*, **2**, 371–375.—The amount of alcohol in an aqueous solution can be estimated by determining the quantity of toluene necessary to cause a cloudiness in the solution. The method can be used only when the solution contains above eighty-five per cent. of alcohol and gives results as accurate as those obtained by the pycnometer test.

The Physical and Chemical Properties of Lithium Benzoate and Lithium Salicylate. By Lyman F. Kebler. *Am. J. Pharm.*, **71**, 57–64.—The properties of samples of lithium salicylate and benzoate, which are on the market, and of the carefully purified salts, are described in detail.

The Electric Current in Organic Chemistry. By Edgar F. Smith. *Proc. Am. Assoc. Advancement Sci.*, *1898*, 179–194.—This paper is a historical address delivered by the author as chairman of the Chemical Section of the Association.

GEOLOGICAL AND MINERALOGICAL CHEMISTRY.

W. O. Crosby, Reviewer.

Notes on North Carolina Minerals. By J. H. Pratt. *J. Elisha Mitchell Sci. Soc.*, **14**, *pt.* 2, 61–83. The notes on four of the nine minerals considered in this article, wellsite, anorthite, cyanite and zircon, have been published elsewhere and noticed in this Review. The remaining species are chabazite, anthophyllite, enstatite, enstatite (bronzite), and emerald beryl. The chabazite occurs as minute crystals coating feldspar, hornblende and corundum and intimately associated with the wellsite, in a corundum mine in Clay County. Two analyses are given; and the ratio of Al_2O_3 to the protoxide bases is found to be somewhat below the normal. The anthophyllite, which occurs in dunite rock near Bakersville, was originally described by Penfield in 1890, before the locality was known. A new analysis is given, and Penfield's analysis is quoted for comparison, the two agreeing very closely, and closely approximating the normal composition. The enstatite forms rock masses bordering the dunite of Corundum Hill. The analysis indicates the admixture of 35 per cent. of serpentine and 20.5 per cent. of talc, the pure enstatite forming but 44.5 per cent. of the whole. The bronzite forms with an emerald-green diopside a tough rock (websterite) in the dunite of the Tuckaseegee Valley; and the websterite also varies to a nearly pure bronzite rock. The analysis and physical characters show this to be a very typical bronzite. The emerald beryl occurs in a vein of pegmatite, and is in part of gem quality; but it has not been analyzed. All of the new analyses of the foregoing minerals were made by Chas. Baskerville of the N. C. Geological Survey.

The Origin and Chemical Composition of Petroleum. A SYMPOSIUM. BY S. P. SADTLER, S. F. PECKHAM, DAVID T. DAY, FRANCIS C. PHILLIPS AND CHARLES F. MABERY. *Proc. Am. Phil. Soc.*, 36, 93–140.—This paper is a valuable summary of our knowledge of petroleum and natural gas, and in a measure of all of the native bitumens. Prof. Sadtler discusses the genesis and chemical relations of petroleum and natural gas; and rejecting all the theories of the inorganic origin of these bodies, and weighing carefully the rival theories of their derivation from animal tissues and from plants, concludes, partly from original experiments with linseed oil, that both the theories of their organic origin are required to explain all the facts. Prof. Peckham's contribution is on the nature and origin of petroleum, setting forth at some length the facts which appear to sustain the distillation theory, which is made to cover all the native bitumens from natural gas to asphaltum. Dr. Day develops a suggestion as to the origin of Pennsylvania petroleum which is a modification of Mac Gonigle's theory that the Pennsylvania oils have been derived by distillation from the underlying Silurian strata, the transfer from the lower to the higher formations, with a notable increase in density and loss of sulphur, having, according to Day, been accomplished, not by distillation but by an upward filtration through beds of shale. Prof. Phillips discusses and accepts provisionally Mendeléeff's theory that metallic carbides have been produced deep in or below the earth's crust, and that these carbides have been decomposed by steam, giving rise to the various hydrocarbons of oil and gas; and in accordance with this view the author argues strongly against the view that petroleum occurring in the cavities of fossils is indigenous in them. Prof. Mabery, in considering the composition of American petroleum, notes the progress of our knowledge, the difficulty of correlating the composition or specific gravity with the distribution or geological occurrence. Even the high sulphur oils, which some have regarded as peculiar to limestones, are shown to be also very typically developed in sandstones and shales. The importance and feasibility of a general system of classification on the basis of the series of hydrocarbons which constitutes the main body of the crude oils are discussed at some length.

The Genesis of Bitumens, as Related to Chemical Geology. By S. F. Peckham. *Proc. Am. Phil. Soc.*, 37, 108–139.—This paper is a sequel to the preceding symposium; but the author contents himself with a very general discussion of the geology of the bitumens and especially of petroleum, and a restatement of the facts supporting the distillation theory of petroleum and natural gas.

M. L. FULLER, REVIEWER.

On Dikes of Felsophyre and Basalt in Paleozoic Rocks in Central Appalachian Virginia. By N. H. Darton. **Notes on the Petrography.** By Arthur Keith. *Am. J. Sci.*, 156, 305–315.—A third locality of igneous rocks in the Central Appalachian region has recently been discovered by Mr. Darton. Both basic and acidic dikes are represented, the latter belonging to the granite family and most nearly resembling felsophyre. Petrographic descriptions of both types are given by Mr. Keith, supplemented by an analysis of the felsophyre by W. F. Hillebrand.

Causes of Variation in the Composition of Igneous Rocks. By T. L. Walker. *Am. J. Sci.*, 156, 410–415.—A brief review is given of the usual theories of magmatic differentiation. The author considers that none give satisfactory explanations of all the phenomena observed, especially of the excessively basic centers of certain eruptive masses. Attention is called to the fact that certain homogeneous solutions remaining for a long time at constant temperatures become gradually more concentrated in the lower portion, and it is urged by the author that a similar concentration probably occurs in complex silicate magmas, especially when near the temperature of consolidation. The material along the borders solidifies before the differentiation is far advanced, representing the original composition. Differentiation and solidification progress simultaneously, and hence the central portions will have suffered the greatest changes. In the upper horizons of the eruptive there would be an increase in *acidity* towards the center; the middle horizons would show little differentiation, while the lower horizons would show an increase in *basicity* towards the center. These relations are illustrated graphically by a diagram. It is not considered that this is ever a sole cause of differentiation. The ability of gravitation to produce concentration in solutions is denied by some physicists, but is upheld by those who have investigated it most carefully.

On the Associated Minerals of Rhodolite. By W. E. Hidden and J. H. Pratt. *Am. J. Sci.*, **156**, 463–468.—The more common associated minerals of this new variety of garnet are quartz, corundum, pleonaste, gahnite, chromite, iolite, staurolite, monazite, zircon, gold, and sperrylite. The occurrence of each is described and analyses by Chas. Baskerville are given for gahnite and iolite.

Platinum and Iridium in Meteoric Iron. By John M. Davison. *Am. J. Sci.*, 157, 4.—After treating the Coahuila and Toluca meteoric irons with hydrochloric acid, there remained in each case a fine black residue consisting of irregular or tetragonal crystals of rhabdite, carbon, and some stony matter. Analyses of these sediments showed the presence of both platinum and iridium. From 608.6 grams of Coahuila iron there were obtained 0.014 gram of platinum, and 0.0015 gram of a black powder, probably iridium. The amounts obtained from the Toluca iron were considerably less. Unsuccessful search was made for microscopic diamonds.

Mineralogical Notes: Analyses of Tysonite, Bastnäsite, Prosopite, Jeffersonite, Covellite, Etc. By W. F. Hillebrand. *Am. J. Sci.*, 157, 51–57.—The analyses of the following minerals were made in the laboratory of the U. S. Geological Survey. 1. Tysonite and bastnäsite. Analyses of fine specimens from Cheyenne Mt., near Pikes Peak, Col., agreed essentially with those of Allen and Comstock. The formulas $R'''F'_3$ for tysonite and $R'''(F',CO''_3)$ for bastnäsite, which in the absence of fluorine determinations have not hitherto been confirmed, are shown to be correct. The analyses show some 40 per cent. of Ce_2O_3 (including ThO_2), with a little less of the La group. 2. Prosopite. A beautiful pale green mineral from Utah, supposed by Kunz to be utahlite, proved on analysis to be prosopite, mixed with quartz and fluorite (?), and colored by some copper salt. Comparison with Altenberg and Pikes Peak prosopites shows a close agreement except in amounts of F and H_2O, the variation of these two affording further evidence as to their mutual replacement by one another. 3. Jeffersonite. An analysis of a brown mineral from Franklin Furnace, N. J., agrees closely with that of jeffersonite but its physical properties differ from hitherto published data of that mineral. The author considers the analysis chiefly valuable as showing a wide range of composition for the mineral. 4. Analyses are also given for covellite, enargite, and a blue stalactite from Butte, Montana, and a fibrous sulphate corresponding to the empirical formula $(FeMn)_4$-$(ZnMg)_2Al_2(SO_4)_9.65H_2O$ from near Whitehall, Montana.

On the Chemical Composition of Tourmaline. By S. L. Penfield and H. W. Foote. *Am. J. Sci.*, 157, 97–125.—This important mineralogical contribution consists essentially of an elaborate review and critical discussion of the investigations of Rammelsberg, Riggs, Jannasch and Kalb, and others upon the constitution of tourmaline. Two new and carefully executed analyses are given which agree closely with those of previous investigators. Rammelsberg's conclusion that all tourmalines are derived from the acid H_6SiO_5 was based on analyses which the authors have shown to be defective. On applying the necessary corrections, however, the general formula $H_{20}B_2Si_4O_{21}$ may be derived, which agrees with that obtained by Riggs, Jannasch, and Kalb, and the authors. A critical examination of the many published analyses, taken in connection with their own analyses of exceptionally pure specimens, leads the authors to the conclusion that all varieties of tourmaline are to be considered as salts of the acid $H_9Al_3(B.OH)_2Si_4O_{21}$, in which the complex aluminium-borosilicic acid radical exerts a *mass effect* by virtue of which the remaining hydrogens may be replaced by numerous metals of essentially different characters without any pronounced effect on crystalline form. The table of the ratios $R' : R'' : R''' : H$, derived from some 35 analyses, including practically all varieties thus far investigated, shows that although certain prominent types undoubtedly exist, the ratios do not approach closely enough to rational members to give definite formulas.

On the Occurrence of Cubanite at Butte, Montana. By Horace V. Winchell. *Am. Geol.*, 22, 245.—An analysis of a brass-yellow ore of copper gave results agreeing closely with both the theoretical composition and with previous analyses of cubanite.

The Origin of the Archean Igneous Rocks. BY N. H. WINCHELL. *Am. Geol.*, **22**, 299–310. It has been previously assumed that the oldest known rocks were of the acid type, but the author has recently endeavored to show that the ferro-magnesian greenstones may be considered as the existing representatives of the original crust, and that the acid rocks are of a later period. T. Sterry Hunt had previously reached a similar conclusion as to the nature of the primitive crust on chemical grounds, and had explained the minerals of the acid rocks as derived by leaching from the ferro-magnesian types, giving as an example of the process, the occurrence of potash feldspar in geodes, etc., in the Keweenawan diabase. The author holds, on the contrary, that the feldspar is probably a true aqueous deposit of material derived from extraneous sources, and that a more probable view as to the origin of the acid rocks is that they have been derived from the fusion of deeply buried sediments. Several supposed examples of such derivation are described, and the process is suggested as a general explanation of the granites throughout Minnesota. The acid elements, however, and especially the potassium, could not have been derived from the basic greenstones. The conclusion is that for these elements we must look to the atmosphere as it existed upon the original congelation of the crust, and this leads up to the question of the chemical properties and volatility of potassium, and its probable activity under Archean conditions.

On the Dikes in the Vicinity of Portland, Maine. BY E. C. E. LORD. *Am. Geol.*, **22**, 335–346.—Both basic and acid types are represented in the dikes of Casco Bay and vicinity, but only the basic varieties are considered in detail. Of these, olivine-diabase-porphyry is represented by 24 dikes, while enstatite-diabase-porphyry and camptonyte are represented by two each. With one exception they have a persistent strike of N. 55° E. Petrographical and mineralogical descriptions are given for each variety and its alteration discussed. Analyses are given for anorthoclase, barkevicitic hornblende, and the enstatite-diabase-porphyry. From the field relations and composition it is concluded that the Casco Bay dikes are genetically related to those of Kennebunkport and Bald Cliff. The similarity in composition to augite-syenite from Norway suggests the possibility that certain of the dikes at least are offshoots of an underlying parental rock of that description. Their age is less than that of the associated pegmatites, and it is conjectured that they are coincident with a period of volcanic activity towards the close of the Devonian, and contemporaneous with the granitic intrusions of Nova Scotia and New Brunswick.

[CONTRIBUTION FROM THE MASSACHUSETTS INSTITUTE OF TECHNOLOGY.]

REVIEW OF AMERICAN CHEMICAL RESEARCH.

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ARTHUR A. NOYES, Editor; HENRY P. TALBOT, Associate Editor. REVIEWERS: Analytical Chemistry, H. P. Talbot and W. H. Walker; Biological Chemistry, A. G. Woodman; Carbohydrates, G. W. Rolfe; General Chemistry, A. A. Noyes; Geological and Mineralogical Chemistry, W. O. Crosby; Inorganic Chemistry, Henry Fay; Metallurgical Chemistry and Assaying, H. O. Hofman; Organic Chemistry, J. F. Norris; Physical Chemistry, H. M. Goodwin; Sanitary Chemistry, E. H. Richards; Technical Chemistry, A. H. Gill and F. H. Thorp.

GEOLOGICAL AND MINERALOGICAL CHEMISTRY.

M. L. FULLER, REVIEWER.

Thomsonite and Lintonite from the North Shore of Lake Superior. BY N. H. WINCHELL. *Am. Geol.*, 22, 347–349.—The paper describes the properties, associations, and localities of both minerals. An analysis of lintonite is given and the reasons (optical) for its separation from mesolite or thomsonite, to which it might be referred on chemical grounds.

Thalite and Bowlingite from the North Shore of Lake Superior. BY N. H. WINCHELL. *Am. Geol.*, 23, 41–44.—The treatment of the subject is mainly descriptive, but includes a new analysis of thalite.

Chlorastrolite and Zonochlorite from Isle Royale. BY N. H. WINCHELL. *Am. Geol.*, 23, 116–118.—The paper includes descriptions of both minerals, with an analysis of the former.

On the Occurrence of Quenstedtite near Montpelier, Iowa. BY OTTO KUNTZE. *Am. Geol.*, 23, 119–121.—The sandstone bed of a small creek is locally incrusted above the water with a dry yellow mineral which on analysis proved to be nearly pure quenstedtite ($Fe_2(SO_4)_3 + 10H_2O$), a mineral previously described by Dana as coming only from Chile. On exposure to direct sunlight it rapidly decomposes and disappears, but under favorable conditions may accumulate to a thickness of 1 or 2 inches during a single summer. The material is derived from the decomposition of fine scales of pyrite, with which the sandstone is filled.

Clay Resources of Missouri. By H. A. Wheeler. *Eng. Min. J.*, **66**, 426–427.—The paper includes statistics relating to the character, use, output, and price of the clays, with a description of the condition of the industry. Analyses are given for white-ware clays, fire clays, potter's clays, shales, brick clays, and gumbo clays.

The Alkaline Reaction of Some Natural Silicates. By F. W. Clarke. *J. Am. Chem. Soc.*, **20**, 739–742.—On adding distilled water containing a very little alcoholic phenolphthalein to samples of certain finely pulverized silicates, including micas, feldspars, zeolites, etc., alkaline reactions were immediately obtained. As would be expected, the colors were most intense in the case of those minerals which in nature are most subject to alteration. Similar results were also obtained from tests upon the common igneous rocks. The rapidity of the action is a striking feature.

Petroleum Inclusions in Quartz Crystals. By Chas. L. Reese. *J. Am. Chem. Soc.*, **20**, 795–797.—Crystals of quartz with petroleum inclusions from Marshall Co., Ala., are described and illustrated. The petroleum was recognized by its fluorescence, odor, and combustibility.

Mineral Resources of Cuba. By Raimundo Cabrera, translated by L. E. Levy. *J. Franklin Inst.*, **146**, 26–41.—Descriptions and analyses are given of the more important ores and economic deposits including asphaltum, phosphate rock, and the ores of gold, silver, lead, copper, iron, and manganese.

The Slate Regions of Pennsylvania. By Mansfield Merriman. *Stone*, **17**, 77–90.—A description is given of each of the principal slate-producing regions, accompanied by tables of statistics relating to the output and properties of the slates. The probable resistance to corrosion by smoke, sulphurous vapors, etc., was tested by treatment for 63 hours in a 2 per cent. solution of $HCl + H_2SO_4$. The results are given in a tabulated form.

The Bayport, Michigan, Quarries. By A. C. Benedict. *Stone*, **17**, 153–164.—The limestone from these quarries is used as road metal, building stone, or burned for lime. Analyses are given for the building stone and lime varieties.

GENERAL AND PHYSICAL CHEMISTRY.

A. A. Noyes, Reviewer.

A Revision of the Atomic Weight of Nickel. II. The Determination of Nickel in Nickelous Bromide. By Theodore

WILLIAM RICHARDS AND ALLERTON SEWARD CUSHMAN. *Proc. Am. Acad.* 34, 327–348.—The authors have found that the samples of nickel bromide previously used (see *this Rev.*, 4, 27) for determining the ratios $NiBr_2 : 2AgBr$ and $NiBr_2 : 2Ag$ contained about 0.1 per cent. of sodium bromide, this contamination having been introduced in the final sublimation of the samples in a porcelain tube. After a fruitless attempt to obtain a pure product by subliming in a platinum-lined tube, the authors decided to make a complete analysis of the slightly impure substance by determining the exact amount of sodium bromide and the amount of nickel present, in the same samples in which the bromine had peen previously estimated. With this end in view it was attempted to precipitate the nickel electrolytically, as had been done by Winkler, but experiments made by dissolving weighed portions of pure spongy nickel and electrolyzing in a platinum dish showed that the weight deposited was always appreciably greater than that of the nickel originally taken (0.2 per cent. greater when the method of Winkler of drying at 50° was followed), probably owing to the inclusion of mother-liquor and of hydrogen. The following method was therefore adopted: the weighed nickel bromide contained in a platinum boat was reduced with moist hydrogen at a comparatively low temperature, the hydrogen replaced by dry air, and the boat weighed; the residue was then digested repeatedly with pure water and the bromine in the filtrates was precipitated and weighed as silver bromide. The possible errors in this procedure were carefully investigated: thus it was shown by rinsing out the cooler parts of the combustion tube with nitric acid that no nickel bromide was lost by volatilization; by exposing the spongy nickel to the air that no oxidation took place; by burning it in air in a combustion tube that no water was produced, and, therefore, that no hydrogen was occluded; and by qualitative analysis of the water extract that it contained nothing but sodium bromide and some nickel dissolved by the action of water on the metal itself. Making proper corrections for the amount of sodium bromide present, the mean values of the atomic weights calculated from the different ratios determined are as follows: 58.703 from $NiBr_2 : 2AgBr$; 58.704 from $NiBr_2 : 2Ag$; and 58.709 from $NiBr_2 : Ni$. As the final value based on all determinations, 58.706 is adopted. The article closes with a criticism of the work of previous investigators on the same subject.

A Revision of the Atomic Weight of Cobalt. II. The Determination of the Cobalt in Cobaltous Bromide. BY THEODORE WILLIAM RICHARDS AND GREGORY PAUL BAXTER. *Proc. Am. Acad.*, 34, 351–369.—This investigation is closely analogous to the one on nickel just reviewed. The cobalt bromide was proved to contain about 0.1 per cent. of impurity by reducing it in hydrogen, leaching with water, evaporating, and weighing the residue, this being admissible in this case since the cobalt dissolved by the water is almost all precipitated in the cobaltic form during the evaporation by the oxidizing action of the air. The residue was found to consist mainly but not wholly of sodium bromide. The final values of the atomic weights derived from each of the ratios determined are: $CoBr_2 : 2AgBr$, 58.995; $CoBr_2 : 2Ag$, 58.987; $CoBr_2 : Co$, 58.998, the final average adopted being 58.995. At the close of the article various criticisms made by Winkler are answered.

Sixth Annual Report of the Committee on Atomic Weights. Results Published in 1898. BY F. W. CLARKE. *J. Am. Chem. Soc.*, 21, 200–214.—The following is a summary of the results published in 1898, the values given by the author in his last year's table being appended in parentheses.

Oxygen, Keiser	15.880	(15.879)
Nitrogen, Dean	14.055	(14.04)
Boron, Armitage	10.959 10.928	(10.95)
Zinc, Morse and Arbuckle	65.457	(65.41)
Cadmium, Morse and Arbuckle	112.377	(111.95)
Selenium, Lenher	79.314	(79.02)
Tellurium, Metzner	127.9	(127.49)
" Heberlein	126.98	(127.49)
Zirconium, Venable	90.78	(90.40)
Thorium, Brauner	232.42	(232.63)
Praseodymium, Jones	140.46	
" Von Schele	140.40	(143.6)
" Brauner	140.95	
Neodymium, Jones	143.6	
" Boudouard	143.045	(140.8)
" Brauner	143.5	

The methods used by Armitage in the case of boron have been subjected to much unfavorable criticism. At the close of the article the author gives his revised table of atomic weights by the side of those of Richards and the German Committee. It is much to be regretted that both the author and the German Committee have ignored the usual practice in regard to significant figures, curiously enough in opposite directions, the latter retaining such a number of figures that the last one is certain, while the author retains always two decimals without reference to the probable accuracy of the result.

The Nature of Valence. BY F. P. VENABLE. *J. Am. Chem. Soc.*, 21, 192–200; 220–231.—Besides presenting at length the views of other chemists the author proposes the hypothesis that valence is not an inherent property of the single atom, but is the resultant of the mutual influence of the atoms entering into combination, "the number of atoms forming one molecule being purely a matter of equilibrium and dependent on the motion of those atoms." The author does not show, however, that this indefinite hypothesis leads to any specific or tangible results. In regard to it the reviewer would remark, somewhat in line with Lothar Meyer's statement quoted by the author, that it is only in so far as valence can be regarded as a constant property of the atom, or in so far as the conditions of its variation can be specifically stated, that the concept of valence has any scientific value.

The Rise of the Theory of Electrolytic Dissociation, and a Few of Its Applications in Chemistry, Physics, and Biology. BY HARRY C. JONES. *Johns Hopkins Hospital Bull.*, 87, 1–10. —A brief address on the subject read before the medical society.

Natural Science of the Ancients as Interpreted by Lucretius. BY F. P. VENABLE. *J. Elisha Mitchell Sci. Soc.*, 15, 62–75.

The Solubility of Iodide in Dilute Potassium Iodide Solutions. BY A. A. NOYES AND L. J. SEIDENSTICKER. *J. Am. Chem. Soc.*, 21, 217–220.—The authors show that the excess of iodine dissolved by potassium iodide solutions over that dissolved by pure water is proportional to the concentration of the iodide (between the concentrations 0.1 and 0.006 normal), and that this result is in accord with the assumption that the complex salt in solution has the formula KI_3, or more correctly that its anions which alone are present in important amounts have the corresponding formula I_3.

The Velocity of the Reaction between Silver Acetate and Sodium Formate. A Reaction of the Third Order. BY ARTHUR A. NOYES AND GEORGE T. COTTLE. *J. Am. Chem. Soc.*, 21, 250–256.—The velocity of the reaction, measured at 100°, is shown to be proportional to the concentration of the formate and the square of that of the silver salt corresponding to the fact that one molecule of the former substance reacts with two of the latter.

H. M. GOODWIN, REVIEWER.

Absorption of Gases in High Vacuum. BY C. C. HUTCHINS. *Am. J. Sci.*, 157, 61–63.—It was found that of the several gases investigated, namely cyanogen, nitrogen, iodine, and oxygen, the latter is by far the least rapidly absorbed by the discharge in a vacuum tube, and in consequence the vacuum in a tube containing this gas is less rapidly raised than in tubes filled with the other gases. The author suggests therefore introducing mercuric oxide around an auxiliary anode as an efficient and simple device for maintaining X-ray tubes at the exhaustion of maximum efficiency.

Note on the Transference Number of Hydrogen. By Wilder D. Bancroft. *J. Phys. Chem.*, 2, 496–497.—This note refers to Hopfgartner's paper in connection with the work of McIntosh on the transference number of hydrogen (see *this Rev.*, 5, 101). The discrepancies between the determinations by these investigators and those of Bein and Kohlrausch cannot yet be satisfactorily explained.

On the Heat of Solution of Liquid Hydriodic Acid. By F. C. Cottrell. *J. Phys. Chem.*, 2, 492–495.—The liquid acid contained in a sealed glass tube was broken in a calorimeter of 500 cc. capacity and the rise of temperature noted. The mean of three determinations gave 148.3 K (1K = 100 g. cal. at 12°). Corrected for that portion of the acid present as saturated vapor in the sealed tube the value is 147.8. From this the molecular heat of condensation of the gas is computed to be 42.8 K.

Variance of the Voltaic Cell. By Wilder D. Bancroft. *J. Phys. Chem.*, 2, 227, 240.—The author takes exception to Nernst's method of application of the phase rule to the Voltaic cell, and then illustrates its use in the case of numerous cells; the application of Le Chateliers theorem in predicting qualitatively the changes in the electromotive force produced by changes in the variables on which the electromotive force depends, is also illustrated by examples.

Electromotive Force between Amalgams. By Hamilton P. Cady. *J. Phys. Chem.*, 2, 551–564.—In this interesting paper the author has verified experimentally the independence, required by the osmotic theory, of the electromotive force of various amalgam cells, of the nature of the solvent, and of the concentration of the solution required. The anomalous results obtained for the molecular weights of the alkali and alkali-earth metals as computed from the electromotive force of such amalgam cells are shown to be in harmony with Ramsay's observations on the vapor-pressure of the same amalgams. These anomalies are shown to disappear when the heat of dilution of the amalgam, which was found to be not inconsiderable, is taken into account. The heat of dilution of sodium amalgam was found to be independent of the temperature between 4° and 22°. An error relative to the electromotive force due to polyatomic zinc ions is corrected by Mr. Bancroft, *J. Phys. Chem.*, 3, 107.

The Isothermal Pressure-surface in the Case of Two Single and One Double Salt. By F. Donnan. *J. Phys. Chem.*, 2, 417–420.—A graphical discussion of the phenomena attending evaporation of a system consisting of two dissolved salts possessing one ion in common.

Solution Densities. By H. T. Barnes and A. P. Scott. *J. Phys. Chem.*, 2, 536–550.—The authors have determined the densities of a number of salt solutions at various concentrations, and have constructed plots with differences between the observed densities and the values computed on the assumption that no volume change occurs on dissolving the salt as ordinates, and weights of dissolved substance as abscissae. From the plots thus obtained the authors believe that abrupt changes of curvature are unmistakable, although they do not seem to wish to advance or advocate any "hydrate" theory in explanation. That such breaks are really present, however, does not appear probable to the reviewer, nor are they evident in the data presented.

Dissociative Power of Solvents. By Louis Kahlenberg and Azariah T. Lincoln. *J. Phys. Chem.*, 3, 12–36.—To test Nernst's rule of the relation between dissociating power and dielectric constant, the authors have studied qualitatively the relative dissociating power of some seventy-five organic liquids by means of the conductivity of salts dissolved in them. The chlorides of iron, antimony, bismuth and mercury were used as solutes. The rule was found to be verified with but few exceptions. In general the experiments show that solutions in hydrocarbons or their halogen substitution-products do not conduct; that alcoholic solutions conduct comparatively well, the power diminishing with increasing percentage of carbon in the molecule; that phenols conduct less than alcohols, ethers and acid anhydrides, slightly or not at all; aldehydes, relatively well; that nitriles and nitrogen compounds containing oxygen combined with the nitrogen both give conducting solutions, while amido compounds of the aromatic series do not. Numerous instances were noted which do not confirm Brühl's theory that solvents possessing dissociating power are unsaturated compounds, so that this theory is believed to be untenable. The paper also contains quantitative measurements of the conductivity of the chlorides mentioned above in some of the better conducting solvents, and both conductivity and freezing-point measurements on nitrobenzene solutions. The results in general indicate that cryoscopic and conductivity measurements do not in many cases agree in the case of non-aqueous solutions, and that an extension or modification of the dissociation theory may be necessary, when sufficient data to warrant general conclusions have been obtained.

Boiling-Point Curves. By E. F. Thayer. *J. Phys. Chem.*, 3, 36–40.—An extension of previous work (*this Rev.*, 4, 90) to mixtures of alcohol and chloroform, alcohol and acetone, and chloroform and acetone, is described. The chloroform-alcohol curve possessed a minimum boiling-point at 58.5° under 732.5 mm. pressure, for a mixture containing about 7 per cent. alcohol. The chloroform-acetone curve showed a maximum boiling-point at 63.4° under 737.1 mm. pressure, for a mixture containing about 19 per cent. acetone. All mixtures of alcohol and acetone boiled between the boiling-points of their two constituents.

Determination of the Molecular Rise in Boiling-point of Liquid Ammonia. BY E. C. FRANKLIN AND C. A. KRAUSS. *Am. Chem. J.*, **20**, 836–853.—A modified form of Beckmann apparatus suitable to this low-boiling solvent was used. The molecular elevation for water and for alcohol were satisfactorily constant, both giving the same value, 3.4. Other organic solutes gave less satisfactory values, but all were of about the same order of magnitude. The salts investigated, namely, ammonium nitrate, sodium nitrate, and potassium iodide gave, in view of the high electrical conductivity of their solutions, values surprisingly low, indicating small dissociation. Metallic sodium gave a molecular elevation varying from 1.50 to 2.30, indicating a molecule containing two atoms in solution.

Some Properties of Liquid Ammonia. BY E. C. FRANKLIN AND C. A. KRAUSS. *Am. Chem. J.*, **21**, 8–14.—The authors have compared, as far as existing data permit, the various physical properties of liquid ammonia with the corresponding properties of water, thus bringing out the close relationship between these two solvents. The properties discussed are the conductivity of ammonia solutions, ammonia of crystallization, specific and latent heats, boiling-point, molecular elevation of boiling-point, dielectric constant, and molecular association.

Note on the Spectra of Hydrogen. BY THEODORE W. RICHARDS. *Am. Chem. J.*, **21**, 172–174.—The author points out in explanation of certain recent results of Hutton that water vapor gives the pure red spectrum of hydrogen more readily than hydrogen itself and that this spectrum is doubtless due to dissociated atoms rather than hydrogen molecules. The "white spectrum" of hydrogen, on the other hand, is obtained only in the absence of vapor; it is not to be regarded as due to impurities.

Specific Gravity of Sodium Chloride Solutions. BY H. C. HAHN. *J. Am. Chem. Soc.*, **20**, 621–630.—Specific gravity determinations of solutions varying in concentration from 5 per cent. to saturation at 15° C. are given to six significant figures, and several interpolation formulae with three and four constants are calculated for expressing the results.

[CONTRIBUTION FROM THE MASSACHUSETTS INSTITUTE OF TECHNOLOGY.]

REVIEW OF AMERICAN CHEMICAL RESEARCH.

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ARTHUR A. NOYES, Editor; HENRY P. TALBOT, Associate Editor.

REVIEWERS: Analytical Chemistry, H. P. Talbot and W. H. Walker; Biological Chemistry, A. G. Woodman; Carbohydrates, G. W. Rolfe; General Chemistry, A. A. Noyes; Geological and Mineralogical Chemistry, W. O. Crosby; Inorganic Chemistry, Henry Fay; Metallurgical Chemistry and Assaying, H. O. Hofman; Organic Chemistry, J. F. Norris; Physical Chemistry, H. M. Goodwin; Sanitary Chemistry, E. H. Richards; Technical Chemistry, A. H. Gill and F. H. Thorp.

GENERAL AND PHYSICAL CHEMISTRY.

H. M. GOODWIN, REVIEWER.

A New Determination of the Electrochemical Equivalent of Silver. BY GEO. W. PATTERSON, JR., AND KARL E. GUTHE. *Phys. Rev.*, 7, 258–282.—The discrepancy between the values of the mechanical equivalent of heat as determined by the direct and by the electrical method, led the authors to believe it might be due to errors in the standards used, in particular in the value of the ampere. A redetermination of the electrochemical equivalent was therefore undertaken. The investigation was carried out with great care in all its details, and is of particular value, as it does not involve either the acceleration due to gravity or the horizontal intensity of the earth's magnetism. The method consists essentially in balancing the electrodynamic action of the coils of a primary electrodynamometer (of special design) against the torsional moment of a phosphor-bronze wire. The measurements involved are only those of mass and time, and the authors regard their results as accurate to one part in five thousand. A silver voltameter was used with the usual precautions. The final value—the mean of four determinations—of the electrochemical equivalent of silver was found to be 0.0011192+ gram per ampere per second. This value is about $\frac{1}{9}$ per cent. greater than that generally accepted. It agrees with the average value of Pellat and Potier, and is almost identical with that given by Kahle (0.0011193 gram). Assuming the above value, the discrepancy between Griffith's and Rowland's value for the mechanical equivalent of heat disappears.

On the Density of Ice. By Edward L. Nichols. *Phys. Rev.*, 8, 21–37.—The first part of the paper contains a critical review of previous determinations of this constant, and brings out the fact that although the results of individual observers check well among themselves the agreement is not satisfactory when the results of different observers are compared. It seemed not unlikely that the nature of the ice itself was the cause of the discrepancy. To settle this point and particularly to determine the density of ice as formed in the ice calorimeter, the author made a number of careful determinations of ice from various sources, and found that the density is not the same under all circumstances, as is shown by the following values (referred to water at 0°): Ice frozen with carbon dioxide and ether, 0.91615 ± 0.00009; natural icicles, 0.91807 ± 0.00004; newly cut pond ice, 0.91804; pond ice one year old, 0.91644.

On the Dielectric Constant and Electrical Conductivity of Liquid Ammonia. By H. M. Goodwin and M. de Kay Thompson, Jr. *Phys. Rev.*, 8, 38–48.—The di-electric constant of liquid ammonia was measured by Drude's method of electrical resonance; and values varying from 21 to 23, according to the preparation of the ammonia, were obtained at its boiling-point (—34° C.) under atmospheric pressure. This value, which is very low compared with that of water, would seem to indicate that liquid ammonia is an exception to Nernst's Law, since reasoning from the experiments on the electrical conductivity of liquid ammonia solutions made by Cady and the authors, ammonia is probably a solvent of high dissociating power. A convenient method for measuring the conductivity of this solvent is described and results on solutions of silver nitrate are given.

On the Osmotic Pressure of Certain Ether Solutions and Its Relation to Boyle-van't Hoff's Law. By H. M. Goodwin and Geo. K. Burgess. *Phys. Rev.*, 7, 171–187.—The lowering of the vapor-pressure of solutions of naphthalene, benzophenone, and diphenylamine in ether was measured directly, by causing the solutions and the pure solvent to boil at constant temperature. Equality of temperatures was indicated by a platinum resistance thermometer placed in the boiling flasks, and pressures were measured on a mercury manometer by means of a cathetometer. From the observed vapor-pressure lowerings the corresponding osmotic pressures, P, of the solutions were computed by an exact formula which took into account the deviations of the pressure of the solvent vapor from Boyle's Law. The concentration of the solutions was reduced to mols per liter by means of specific gravity determinations, so that a direct investigation of the relation $PV = RT$ could be made. It was found that the product PV instead of being constant, diminished in all cases with increasing concentration. The form of the PV curves varied with the solute, and was in general similar to the well-known curves exhibited by imperfect gases under high pressure. It would seem that each solute therefore deviates from the Boyle-van 't Hoff Law in much the same way that most gases deviate from the ideal gas laws, each substance having its own characteristic "condition-equation." Azobenzene investigated by Noyes and Abbot follows the perfect gas laws more nearly than any of the other substances thus far investigated.

ANALYTICAL CHEMISTRY.

ULTIMATE ANALYSIS.

H. P. TALBOT, REVIEWER.

The Determination of Potash as Perchlorate. BY F. S. SHIVER. *J. Am. Chem. Soc.*, 21, 33–42.—Following a review of the various methods proposed for the determination of potassium, the author presents the results of experiments from which he concludes that the method of Caspari (*Ztschr. angew. Chem.*, *1893*, 68), as modified by Kreider (*Am. J. Sci.*, 149, 443), will yield results equal in accuracy to those obtained by the use of platinum, in the case of mixtures free from other bases and non-volatile acids, and that it seems likely to prove satisfactory in the presence of these substances. Four procedures for the preparation of perchloric acid, those of Schlösing and of Porrey (both to be found in Grandeau's *Traité d'Analyse des Matieres agricoles*, 1, 88–91), Caspari (*Ztschr. angew. Chem.*, *1893*, 68), and Kreider (*Loc. cit.*), are briefly described.

A New Method for the Determination of Zinc. BY A. C. LANGMUIR. *J. Am. Chem. Soc.*, 21, 115–118.—In the method proposed, the zinc precipitate (sulphide) is dissolved in nitric acid, the solution evaporated, and the zinc converted to oxide by ignition. It is recommended that the zinc be thrown down from a dilute solution, and that the precipitate be dissolved without washing, to avoid the usual difficulties at this point, and that the impurities in the ignited oxide be determined and deducted from the apparent weight. In the analysis of many alloys containing zinc, the solution from which the copper and lead have been removed by electrolysis, may be directly evaporated and the residue strongly ignited.

The Determination of Arsenic in Glycerine. BY A. C. LANGMUIR. *J. Am. Chem. Soc.*, 21, 133–136.—The glycerine is destroyed by evaporation with sulphuric and nitric acids, transferred to a Marsh generator, and the gas passed through a hard glass tube, constricted as usual, with a piece of filter-paper moistened with mercuric chloride solution beyond the constriction to detect any escaping arseniuretted hydrogen. The portion of the tube containing the mirror is cut off and weighed. It is then cleaned, dried, and again weighed. The Gutzeit test, using mercuric chloride instead of silver nitrate, also yields good results.

Note—Drown's Method of Determining Silicon. By A. C. Langmuir. *J. Am. Chem. Soc.*, **21**, 215.

Notes on the Rapid Determination of Tungsten in Steel. By George Auchy. *J. Am. Chem. Soc.*, **21**, 239–245.—The author finds that the amount of ferric oxide which remains with the tungstic acid in the Blair procedure is, for the same class of steels, fairly constant, and that fusion with sodium carbonate may possibly be omitted. He finds that the amount of hydrochloric acid present when the tungstic acid is filtered off affects the determination, and that evaporation to dryness from a nitric acid solution does not always effect complete separation of the tungsten, while the separation is complete when hydrochloric acid is used. About 5 cc. of hydrochloric acid should be present when filtration takes place. In low phosphorus steels, the phosphorus may be determined as usual in the presence of the tungsten, provided the precipitate does not stand more than 2½ hours, and an excess of ammonia is avoided. The same procedure as for steels is found to succeed with ferrotungstens.

W. H. WALKER, REVIEWER.

Volumetric Method for the Estimation of Boric Acid. By L. C. Jones. *Am. J. Sci.*, **157**, 147–153.—In order that boric acid may be estimated volumetrically by titration with standard alkali, it is necessary to obtain it as the uncombined acid in a solution of neutral salts free from carbonic acid. The following procedure is found to fulfil these requirements more perfectly than any other method hitherto proposed, and to furnish a rapid and convenient method for estimating boric acid in any compound decomposable by hydrochloric acid. The boric acid is set free by the addition of dilute hydrochloric acid in slight excess, and 5 cc. of a ten per cent. barium chloride solution are added to combine with any carbonic acid that may subsequently be introduced with the standard alkali solution. The excess of hydrochloric acid is now destroyed by adding a considerable quantity of a solution of potassium iodate, and the iodine set free by this reaction is taken up by a dilute solution of sodium thiosulphate. The boric acid may now be neutralized by standard sodium hydroxide, phenolphthalein being used as an indicator. When the red color first appears, 1–2 grams mannite are added and the alkali again run in to a faint alkaline reaction, which if permanent on the addition of more mannite, may be taken as the end-point. The best results are obtained in a cold concentrated solution, and under these conditions the experimental data given show the method to be very accurate.

PROXIMATE ANALYSIS.

A. H. GILL, REVIEWER.

The Heat of Bromination Test for Oils. BY AUGUSTUS H. GILL AND ISRAEL HATCH, JR. *J. Am. Chem. Soc.*, 21, 27–29. —The calorimeter employed was double jacketted. The values obtained with the oils were compared with that obtained by brominating camphor; the results are expressed as a "specific temperature reaction," which, by multiplying by a constant, gives an iodine number which agrees well with that found in the usual way.

The Analytical Constants of American Linseed Oils. BY AUGUSTUS H. GILL AND AUGUSTUS C. LAMB. *J. Am. Chem. Soc.*, 21, 29–30.—The specific gravity, Valenta, Maumené, iodine, and drying tests of raw, boiled, and bleached oils of undoubted purity are given.

Analytical Research on Sod Oil. BY E. HOPKINS, D. L. COBURN, AND E. SPILLER. *J. Am. Chem. Soc.*, 21, 291–300.— Sod oil is the excess of oil extracted from ordinary leather in the currying process, menhaden and cod oils being used principally for this purpose, although other oils and greases are employed. It can hence have no well-defined constants, but there is little difficulty in distinguishing it from other oils. Moisture is determined by sucking air through the oil absorbed upon filter papers contained in a tube heated in an oven at 100° C. The oil is obtained by extracting this residue with 40° b. pt. gasoline; and this is followed by extraction with alcohol giving the soap; upon igniting the residue the ash is determined, and the hide fragments are ascertained by difference. Dégras former is estimated by saponifying the oil, evaporating to dryness, extracting the soap formed with water, and precipitating this with salt. The solution is filtered, the dégras former passing into the filtrate, where it is precipitated by hydrochloric acid; it is filtered off and dissolved in alcohol, the alcohol is evaporated, and the residue weighed. In addition to these determinations, tables are given showing the saponification number, mineral acid, free acid, total acid, ether number, Reichert-Meissl, iodine, and unsaponifiable numbers.

The Absorption of Methane and Ethane by Fuming Sulphuric Acid. BY R. A. WORSTALL. *J. Am. Chem. Soc.*, 21, 245–251.—The article shows that contrary to accepted facts, both these gases are absorbed by the acid. The absorption in the case of methane was as follows: In ½ hour, 0.1 cc.; in 2 hours, 1.7 cc.; in 4 hours, 5.4 cc.; 24 hours, 6.8 cc.; and in 5 days, 11 cc. Natural gas containing 96 per cent. of methane showed an absorption varying from 0.3 to 3.3 per cent. Ethane is absorbed in a quantity varying from 3.5 to 7 per cent. The results of this investigation show that in gas analysis the gas should not stand longer than an hour over sulphuric acid, and if ethane be present not more than fifteen minutes.

A. G. WOODMAN, REVIEWER.

Butter and Butter Adulterants. BY C. B. COCHRAN. *J. Franklin Inst.*, 157, 85–97.—For the purpose of detecting and estimating small amounts of foreign fat in butter, the author considers the following tests most satisfactory: Direct microscopic examination of the sample by polarized light; microscopic examination of the crystals from solution in amyl alcohol, both with and without polarized light; Valenta test; Reichert number; reading of butyrorefractometer. It is concluded that if the conditions of crystallization are kept uniform the crystalline deposit obtained from the solution of pure butter-fat in amyl alcohol is characteristic of butter. Photomicrographs are given illustrating this. Results are also given of the examination of several samples of renovated butter; that is, stale butter in which the fat has been separated from the curd and water, and then emulsified with milk or buttermilk, being thus made again into butter.

Detection of Caramel in Spirits and Vinegar. BY C. A. CRAMPTON AND F. D. SIMONS. *J. Am. Chem. Soc.*, 21, 355–358.—It has been found that fuller's earth has a greater affinity for the artificial coloring-matter of spirits than for that derived naturally from the wooden containers, and the method given for the detection of caramel is based upon the observation that a much greater percentage of color is removed from the artificially colored samples by means of this substance.

G. W. ROLFE, REVIEWER.

Study of Starch Grains and Its Application. BY H. KRAEMER. *Am. J. Pharm.*, 71, 174–189.—This paper treats of the origin of starch in plants as indicated by the researches of the biologist and botanist, and of the physical and chemical examination of starch by the microscope. The author argues for more expert work by the botanist and biologist in food analysis.

Some Notes on the Estimation of Carbohydrates. BY F. W. TRAPHAGEN AND W. M. COBLEIGH. *J. Am. Chem. Soc.*, 21, 369–373.—The authors describe their modification of the Fehling determination. They measure the amount of precipitated copper oxide volumetrically by the permanganate method. They eliminate errors to a large extent by checking the process on solutions of similar known composition and of practically identical reducing value. Excellent results are obtained. As the Fehling determination is influenced so much by apparently insignificant points of manipulation, a more detailed description of the authors' method would be desirable.

E. H. RICHARDS, REVIEWER.

The Estimation of Nitrates and Ammonia in Water. BY FRANK X. MOERK. *Am. J. Pharm.*, 71, 157–161.—Instead of using milk of alumina to remove the organic matter which interferes with the color in the phenol-sulphonic acid test for nitrates in water samples, the author makes a duplicate determination for color due to the organic matter. The remarks on ammonia determinations do not agree with the experience of the reviewer; for, while it is true that "dilute ammonium chloride will not keep indefinitely," unless under conditions of complete sterilization, it is not true "that it is useless to attempt" to free alkaline potassium permanganate "from ammonia, as it cannot be kept so." With pure reagents and suitable preparation of them, the solution, even if not at first, yet on standing, yields ammonia-free distillates.

BIOLOGICAL CHEMISTRY.

A. G. WOODMAN, REVIEWER.

Digestive Ferments with Especial Reference to the Effects of Food Preservatives. BY HENRY LEFFMANN. *J. Franklin Inst.*, 147, 97–108.—The author has studied the action of the more commonly used food preservatives in preventing starch digestion by various enzymes. A number of qualitative experiments in which the action was followed by means of tests with a solution of iodine in potassium iodide are recorded, and in a few cases the amount of dextrose formed was determined by Fehling's solution. It was found that salicylic acid is distinctly antagonistic to the starch-converting enzymes but does not interfere very much with proteid digestion; sodium benzoate, boric acid, borax, and boroglycide do not interfere appreciably with either starch or proteid digestion; beta-naphthol interferes with the action of malt-diastase but not seriously with taka-diastase or pancreatic extract, although it interferes decidedly with the peptic and pancreatic digestion of proteids. Sodium fluoride and sodium silicofluoride offer but little hindrance to starch transformation except in the case of the pancreatic digestion.

On the Presence of Cholin and Neurin in the Intestinal Canal during its Complete Obstruction—A Research on Autointoxication. By BEATTIE NESBITT. *J. Expt. Medicine*, 4, 1–18.—The author has carried out experiments on dogs by closing the intestinal canal by means of a ligature, the animals having been fed on yolks of eggs, which are very rich in lecithin. The contents of the intestine were examined, care being taken to avoid the decomposition of the lecithin during analytical treatment, and cholin and neurin were detected and separated by means of their platinum salts. The conclusion is reached that complete occlusion of the small intestine at its lower end causes the formation of cholin and neurin, possibly other bases also, if the food given contains any considerable amount of lecithin.

Action of Formaldehyde on Enzymes and on Certain Proteids. BY C. L. BLISS AND F. G. NOVY. *J. Expt. Medicine*, 4, 47–80.—A systematic study has been made of the action of formaldehyde on various preparations of pepsin, rennin, pancreatin, ptyalin, diastase, and papaïn. The method adopted was to dissolve a certain amount of the ferment in distilled water and divide this solution into portions. A definite amount of "formalin" was added to each portion so that the liquid contained known amounts of formaldehyde, varying usually from 1 : 100 to 1 : 1000. These mixtures were allowed to stand in closed flasks at ordinary room temperature, portions being tested from time to time. Fresh, well-washed blood fibrin was used to test the proteolytic ferments, and freshly prepared starch paste for the diastatic experiments. It was found that fibrin is altered and rendered less digestible by formaldehyde; similarly, the casein of milk undergoes rapid alteration in contact with formaldehyde, and is only very slowly coagulated by rennet and is digested with difficulty by the proteolytic ferments. Pepsin was not affected even by a five per cent. solution of formaldehyde acting for three weeks, and the same general result was reached in the case of rennet. Papaïn was very quickly altered by formaldehyde even in very dilute solution, and trypsin was also altered greatly, depending, however, on the amount of organic matter that was present. Ptyalin, like the diastatic ferment of the pancreas, was found not to be destroyed by dilute solutions of formaldehyde, but was destroyed after some time by strong solutions. Malt diastase was not destroyed by formaldehyde in moderate amounts and at room temperature. The favoring action of formaldehyde on diastase is considered to be really due to the protection of the diastase against decomposition by preventing the growth of the micro-organisms.

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REVIEW OF AMERICAN CHEMICAL RESEARCH.

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ARTHUR A. NOYES, Editor.

REVIEWERS: Analytical Chemistry, H. P. Talbot and W. H. Walker; Biological Chemistry, A. G. Woodman; Carbohydrates, G. W. Rolfe; General Chemistry, A. A. Noyes; Geological and Mineralogical Chemistry, W. O. Crosby and M. L. Fuller; Inorganic Chemistry, Henry Fay; Metallurgical Chemistry and Assaying, H. O. Hofman; Organic Chemistry, J. F. Norris; Physical Chemistry, H. M. Goodwin; Sanitary Chemistry, E. H. Richards; Technical Chemistry, A. H. Gill and F. H. Thorp.

BIOLOGICAL CHEMISTRY.

A. G. WOODMAN, REVIEWER.

Analysis of Commercial Vinegar. BY FRANK G. RYAN. *Am. J. Pharm.*, 71, 71–73.—The author presents the results of analysis of three commercial samples of vinegar obtained by the methods recommended by Smith (*this Rev.*, 4, 63).

The Adulteration of Flour. BY W. A. WITHERS AND G. S. FRAPS. *N. C. Agr. Expt. Sta.*, *Bull.* 156, 59–67.—The principal adulterant found was corn flour, which was present in sixteen per cent. of the samples.

The Alkali Soils of the Yellowstone Valley. BY MILTON WHITNEY AND THOS. H. MEANS. *U. S. Dept. Agr.*, *Div. of Soils*, *Bull.* 14, 1–37.

Commercial Fertilizers. *Conn. Agr. Expt. Sta.*, *Ann. Rep*, 22, 1-97; *Me. Agr. Expt. Sta.*, *Bull.* 50, 1-8; *La. Agr. Expt. Sta.*, *Bull.* 54, 60-98; *Ky. Agr. Expt. Sta.*, *Bull.* 79, 159-197; *Md. Agr. Coll. Quart.*, 3, 1-50; *Wis. Agr. Expt. Sta.*, *Bull.* 73, 1-10.

Proximate Analysis of Bark of Pinus Echinata, Miller. BY CHRIS. KOCH, JR. *Am. J. Pharm.*, 71, 164-170.—The results given were obtained on the bark of a young tree and comprise moisture and ash and the results of extraction by various solvents, following Dragendorff's scheme for plant analysis.

Dietary Studies in Chicago. BY W. O. ATWATER AND A. P. BRYANT. *U. S. Dept of Agr.*, *Expt. Sta. Bull.* 55, 1-76.—

The general plan of the inquiry was similar to that of investigations published in previous Bulletins. The studies were chiefly made among families of the foreign-born population of Chicago, including Italians, French Canadians, Russian Jews, and Bohemians. The dietaries of three families of Americans were also studied.

E. H. RICHARDS, REVIEWER.

Report on the Investigations into the Purification of the Ohio River Water at Louisville, Ky. BY GEORGE W. FULLER. *Monograph*, 1–480. **Report of the Filtration Commission of the City of Pittsburg.** 1–393.—In several respects these two reports supplement each other and taken together mark an era in the study of water filtration problems under conditions common in America. The chemical analysis of the waters derived from two great water-sheds and the effects of the various experimental processes upon their composition, furnish valuable data for the water analyst as well as for the sanitary engineer. In both reports will be found much of interest in regard to the formation of boiler scale.

G. W. ROLFE, REVIEWER.

Sugar Beet Experiments during 1898. BY ALFRED J. MCCLATCHIE AND ROBERT H. FORBES. *Bull Ariz. Agr. Expt. Sta.*, 30, 190–225.—The results show that sugar beets can be raised, and sugar manufactured, profitably in the Salt River Valley. The fuel question is the most serious one.

Sugar Beet Investigations in Wisconsin during 1898. BY F. W. WOLL. *Bull. Wis. Agr. Expt. Sta.*,71, 3-34.—The problem of successful beet culture in the state presents no difficulties. The harvest period lasts about 55 days and can be extended a month longer by the use of silos.

The Sugar Beet. BY H. J. WATERS. *Bull. Mo. Agr. Expt. Sta.*, 45, 20–32.—The investigation of the quality of the beets raised in different parts of the state has been concluded. The results show a close agreement with those of the U. S. Dept. of Agriculture, and confirm the opinion of the latter that Missouri is not favorably located for beet culture.

Sugar Beets. BY J. T. WILLARD AND R. W. CLOTHIER. *Bull. Kan. Agr. Coll. Expt. Sta.*, 83, 2-16.—Data are so far insufficient for satisfactory conclusions.

Sugar Beet Investigations for 1898. BY J. L. STONE, L. A. CLINTON, G. W. CAVANOUGH, and A. L. KINSLEY. *Bull. Cornell Agr. Expt. Sta.*, 166, 417-468.—The data relate principally to experiments in cultivation with their effects on the quality of the beet. Illustrations are given of the factories at Rome and Binghamton and of the apparatus used in the chemical investigation.

Sugar Beets. Notes for 1897. *Bull. Nev. Agr. Expt. Sta.* 37, 3-16.—General information for the farmer.

APPARATUS.

A. H. GILL, REVIEWER.

A Condenser for Extraction Work. BY C. G. HOPKINS. *J. Am. Chem. Soc.*, 20, 965.—This is a tubular condenser cooled internally.

On a Balance for Use in Courses in Elementary Chemistry. BY C. E. LINEBARGER. *J. Am. Chem. Soc.*, 21, 31-33.—This balance—called the Chaslyn balance—resembles in form the familiar Westphal balance for specific gravity determinations. It has a capacity of 111 grams and is sensitive to 0.01 gram when loaded. It would seem to be admirably adapted to the purpose.

Improved Apparatus. BY J. L. SAMMIS. *J. Am. Chem. Soc.*, 21, 42-45.—A burette is described and sketched with an S-shaped connection at the bottom so that it can never deliver more than 50 cc. Directions are also given for the manufacture of an electric stove for use in ether extractions.

A New Apparatus for the Determination of Volume. BY C. F. MCKENNA. *J. Am. Chem. Soc.*, 21, 50-52.—This apparatus for determining the specific gravity of powdered solids resembles a flask pycnometer with two narrow graduated tubes fused on. The substance is introduced through one of these having an expansion above closed by a tubulated ground glass stopper. The volume, before and after adding the solid, is read off on the other narrow tube, after bringing the liquid to a zero point in the former tube by exerting suitable air pressure on its surface through the tubulated stopper. No glass joints are in contact with the liquid, thus preventing leakage.

Baume's Hydrometer—American Standard. BY. S. S. EMERY. *J. Am. Chem. Soc.*, 21, 119-132.—This article consists of a table showing the comparison of Baumé degrees with specific gravities for liquids heavier and lighter than water.

A New Filtering Medium. BY G. W. SARGENT AND J. K. FAUST. *J. Am. Chem. Soc.*, 21, 287-288.—A quarter-inch layer of sand supported below by glass wool, covered with asbestos, and held in place by glass beads, is placed in a carbon funnel and washed with nitric acid. This filter is especially applicable for manganese dioxide and ammonium phosphomolybdate. The work with them is as accurate as with paper, much more rapid, and less expensive.

A Method for Cleansing Burettes. Note. BY W. GLENN. *J. Am. Chem. Soc.*, **21**, 302.—The method consists in the use of chromic acid. The reviewer having used this method for the last fifteen years can attest its efficacy, if the acid be concentrated (see also Talbot, *Quant. Analysis*, p. 58 (1897), and *J. prakt. Chem.*, **79**, 117).

INORGANIC CHEMISTRY.

HENRY FAY, REVIEWER.

On an Isomer of Potassium Ferricyanide. BY JAMES LOCKE AND GASTON H. EDWARDS. *Am. Chem. J.*, **21**, 193–206.—By treating potassium ferricyanide with potassium chlorate and hydrochloric acid Skraup obtained a red solution from which, by repeated precipitations with alcohol, he obtained an amorphous, hygroscopic powder, to which he assigned the formula $K_3Fe(CN)_6$, although he was not able to prepare it in pure condition. The authors, by modifying Skraup's conditions, have been able to obtain a pure crystallized product. Potassium ferricyanide was heated to 95° C. with hydrochloric acid and potassium chlorate until effervescence began. The solution was cooled to 20° and filtered; and to the cool filtrate slightly less than an equal volume of alcohol was added. This produced a heavy crystalline precipitate. By partial reprecipitation the crystals were obtained pure, and on analysis were shown to have the composition represented by the formula $K_3Fe(CN)_6.H_2O$. The substance is an isomer of potassium ferricyanide, and the authors propose to name it potassium β-ferricyanide. Like the ordinary salt, this isomer yields characteristic precipitates with the solutions of the heavy metals. These have, in general, the same characteristics as the salts of the normal ferricyanide, and in some cases pass over into the latter with extreme ease. The precipitate of the β-ferricyanide with silver nitrate is dark-brown and flocculent, and when heated in its mother-liquor to 100° passes over into the bright-orange of the α-ferricyanide. The potassium β-ferricyanide can readily be distinguished from the normal ferricyanide by the fact that with bismuth nitrate solutions it does not form a precipitate, while the α-ferricyanide produces an insoluble straw-colored precipitate. Stannic chloride, on the other hand, yields no precipitate with potassium α-ferricyanide, but precipitates the isomer completely. No explanation of the isomerism is offered.

On the Formation of Potassium β-Ferricyanide through the Action of Acids upon the Normal Ferricyanide. BY JAMES LOCKE AND GASTON H. EDWARDS. *Am. Chem. J.*, 21, 413-418.—It has been shown that the conversion of potassium ferricyanide into potassium β-ferricyanide can be accomplished by any acid, the presence of potassium chlorate not being necessary, as was assumed in a previous paper. Potassium ferricyanide was treated with hydrochloric acid, and from time to time portions were drawn off and precipitated with bismuth nitrate. Subsequently, the percentages of cyanogen which these precipitates contained were determined by reduction with sodium amalgam and titration to potassium α-ferricyanide. The rate of conversion from β- to α-ferricyanide brought about by the catalytic action of acids seems to be directly proportional to the degree of ionization of the acid.

The Action of Metals on Nitric Acid. BY PAUL C. FREER AND GEORGE O. HIGLEY. *Am. Chem. J.*, 21, 377-392.—In previous papers the action of copper, lead, and silver on nitric acid of different strengths has been described. In this research the action of iron on nitric acid, and the effect of electrolytic hydrogen on it, using kathodes of copper, silver, and lead, have been investigated. When iron is dissolved in nitric acid, the reduction-products are nitrogen dioxide, nitric oxide, nitrous oxide, and ammonia. With acid of specific gravity 1.40 nitrogen dioxide and nitric oxide are obtained in proportions varying with the amounts of solvent. These differences caused by using varying amounts of solvent led the authors to the view that nitric oxide is solely a secondary product of the decomposition of the dioxide by water. As the acid diminishes in strength the variation in the relative amounts of these two products is much like that observed with copper, silver, and lead, until a specific gravity of 1.30 is reached when nitrous oxide is formed. With acid having a specific gravity of 1.25 the reaction is further complicated by the appearance of nitrogen and ammonia, the former reaching a maximum at 1.15 and then falling off, while the latter rises to a maximum at 1.05. With platinum electrodes, electrolytic hydrogen acts upon concentrated nitric acid much the same as do copper, silver, and iron, nitrogen dioxide being the principal product. Nitric oxide is produced with acid of specific gravity 1.35, and hydrogen begins to be liberated when acid of 1.30 sp. gr. is used. Small amounts of ammonia are formed only with dilute acid. The activity of electrolytic hydrogen depends, in a marked degree, upon the character of the electrode upon whose surface it is liberated. When nitric acid having a specific gravity of 1.05 is subjected to electrolysis in cells having kathodes of silver and lead, respectively, on the surface of which kathodes there is equal current density, the reduction-products are the same; *i. e.*, nitrogen and ammonia in approximately the same proportions. On the other hand, copper, when made the kathode of an electrolytic cell containing acid of the same strength, has a much greater energizing effect upon the hydrogen deposited upon its surface than is shown by lead under the same circumstances, and produces about three times as much ammonia as the latter. Since in the electrolysis of nitric acid the action of the metallic ions is excluded, and the reduction must be effected by the hydrogen in contact with the surface of the different metals, it follows that the widely different results obtained when lead and silver dissolve in nitric acid cannot be attributed to the hydrogen atoms alone, but must also involve the direct deoxidizing effect of the metals themselves. With concentrated, non-ionized acid the metals alone cause the change, but on dilution both metals and hydrogen cause it.

Preparation of Metallic Tellurium. By VICTOR LENHER. *J. Am. Chem. Soc.*, 21, 347–351.—The author has tried the different methods for the extraction of metallic tellurium from the slimes of the Baltimore Copper Works, and concludes that "reducing sugars will give a very practical method for the preparation of metallic tellurium."

Action of Hypophosphorous Acid upon Molybdic Acid. By CLARENCE EBAUGH AND EDGAR F. SMITH. *J. Am. Chem. Soc.*, 21, 384–386.—A tenth-normal solution of molybdenum trioxide was reduced by hypophosphorous acid both in the presence of a definite excess of that acid and in the presence of sulphuric acid. The reduction is approximately to the oxide Mo_2O_3. Neutral solutions are not reduced.

New Method for the Preparation of Cesium. By HUGO ERDMANN AND A. E. MENKE. *J. Am. Chem. Soc.*, 21, 259–262.—Almost the theoretical yield of cesium was obtained by heating cesium hydroxide with magnesium powder in a red-hot tube, through which a current of hydrogen was passing.

The Specific Gravity of Cesium. By A. E. MENKE. *J. Am. Chem. Soc.*, 21, 420–421.—Not less than four grams of metal were weighed first in hydrogen, then under liquid paraffin. The mean of six determinations gives the value 2.400 for the specific gravity.

The Solubility in Water of Certain Natural Silicates. By GEORGE STEIGER. *J. Am. Chem. Soc.*, 21, 437–439.—Certain silicates were found to give up alkali on long standing with water. The amount of alkali which went into solution was determined by means of standardized hydrochloric acid, using methyl orange as indicator.

ORGANIC CHEMISTRY.

J. F. NORRIS, REVIEWER.

Contribution to Our Knowledge of the Oil of Lemon Grass. BY WILH. STIEHL. *Am. Chem. J.*, **21**, 67–94.—The author shows by a review of the literature that the knowledge of the aldehydes present in the oil of lemon grass is very indefinite. Dodge (*Am. Chem. J.*, **12**, 555) isolated a characteristic aldehyde, $C_{10}H_{16}O$, from the oil and called it citriodoric aldehyde. Later, Tiemann and Semmler (*Ber. d. chem. Ges.*, **26**, 2708) separated geranial, and Doebner (*Ber. d. chem. Ges.*, **27**, 2020) citronellal. Barbier and Bouveault (*Compt. rend.*, **118**, 953, 1050) then showed that citronellal was not present in the oil, and from a study of the semi-carbazones proved that the three aldehydes present were geranial, citriodoric aldehyde, and laevo-licarhodal. And finally, Tiemann (*Ber. d. chem. Ges.*, **31**, 820) asserted that the only aldehyde present in the oil of lemon grass is geranial. The author found it impossible to separate the constituents of the oil by fractional distillation, but by the action of a solution of sodium bisulphite, succeeded in obtaining three aldehydes in pure condition. By using the proper conditions, the bisulphite compound of citriodoric aldehyde remains in solution, that of geranial separates in crystals, and the addition-product of the third compound, allo-lemonal, is decomposed, setting free the aldehyde as an oil. The semi-carbazones, the α-alkyl-β-naphthocinchoninic acids, and the condensation-products with acetone of the three aldehydes, were prepared, and their physical constants determined. It is shown that geranial is not present in natural oil of lemon grass, but that it is formed from the other two aldehydes, a freshly prepared, strongly acid solution of sodium bisulphite effecting the change readily. On the other hand, when geranial is boiled with an aqueous solution of sodium acetate, it is converted into citriodoric aldehyde and allo-lemonal. The condensation-products of the latter aldehydes with acetone readily condense into ring bodies isomeric with ionone, which was obtained by Tiemann in an analogous way from geranial. They have the characteristic odor of violets. From his own work and a study of the literature the author assigns the following formulas to the aldehydes:

$$(CH_3)_2=C=CH-CH_2-CH_2-C(CH_3)=CH-CHO,$$

Citriodoric aldehyde.

$$(CH_3)_2=C=CH-CH_2-CH=C(CH_3)-CH_2-CHO,$$

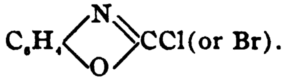
Geranial.

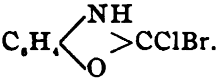
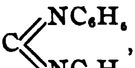
$$(CH_3)_2=C=CH-CH=CH-CH(CH_3)-CH_2-CHO.$$

Allo-lemonal (*l*-licarhodal).

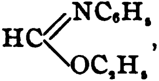
On the Constitution of the Salts of the Imido Ethers and Other Carbimide Derivatives. BY JULIUS STIEGLITZ. *Am. Chem. J.*, 21, 101–111.—This paper is an introduction to two articles by McCoy and by Dains, which are reviewed below. It states briefly the reason for accepting the view that the salts of the imido ethers are formed by the addition of the acid at the double bond, the acid radicle uniting with carbon, in preference to the older view that the salt formation is due to the change in volume of the nitrogen atom.

On the Hydrochlorides of Carbophenylimido Derivatives. BY HERBERT N. MCCOY. *Am. Chem. J.*, 21, 111–167.—Lengfeld and Stieglitz (*Am. Chem. J.*, 16, 70; 17, 98), in the course of a study of the action of phosphorus pentachloride on phenyl urethane, were led to examine the question whether the salts of imido ethers are formed by the addition of acid to the double bond between carbon and nitrogen or by direct addition to the nitrogen atom alone. If the former view is the correct one, the same compound should be formed by the action of hydrochloric acid on ethyl phenylimidobromformate and of hydrobromic acid on ethyl phenylimidochlorformate. These reactions were studied, and, although the reaction-product could not be isolated on account of its great instability, the decomposition-products were identical in both cases. In order to bring more evidence to bear on the subject, the author has investigated two analogous compounds, chlor- and brom-methenyl-*o*-aminophenol,



These compounds, when treated with hydrobromic and hydrochloric acids, respectively, yielded the same product, which from the two methods of preparation must have the formula  $C_6H_4{<}^{NH}_{O}{>}CClBr$. The nitrate and chlorplatinate of chlormethenylaminophenol were analyzed, thus establishing the salt-like nature of the compounds, although the halogen in them was joined to carbon. A number of methods of preparing the necessary aminophenols were studied. By the action of chlorine or bromine on the compound $\underline{O.C_6H_4.NH.CS}$ the corresponding chlor- or brommethenylaminophenol was prepared with excellent yield. An attempt was made to convert carbonylaminophenol, $\underline{O.C_6H_4.NHCO}$, by means of phosphorus pentachloride into chlormethenylaminophenol. A mixture of compounds, from which a very small amount of the phenol could be isolated, was obtained, thus showing that the action of phosphorus pentachloride on urethane is very complicated. In order to prepare the carbonylaminophenol required for the above experiments a new method of preparation was tried, starting from salicylic amide, based on the molecular rearrangement which the bromamides show when treated with alkalies or alcoholic sodium methylate, As a result, 3,5-dibromcarbonylaminophenol was formed, from which the bromine was readily removed by reduction. In order to establish the structure of the monohydrochloride of carbodiphenylimide,  $C\begin{smallmatrix}\diagup NC_6H_5 \\ \diagdown NC_6H_5\end{smallmatrix}$, a study was made of its action on benzene in the presence of aluminium chloride. Since in nearly all syntheses with the Friedel and Crafts reaction the halogen reacting is united with carbon, and since a well-defined condensation-product was obtained in the above case, the conclusion is drawn that in the hydrochloride the chlorine is joined to carbon. By a complete synthesis, in which the structure of the compounds could be followed, the product of the above reaction was shown to be either 2,4-diphenylimido-3(N)-phenyltetrahydroquinazoline or 2-phenylamido-3(N)-phenyl-4-phenylimidodihydroquinazoline. The compound exists in two forms, which are readily converted into each other by recrystallization.

On the Isourea Ethers and Other Derivatives of Ureas. BY F. B. DAINS. *J. Am. Chem. Soc.*, 21, 136–192.—The work reported deals chiefly with methods of preparation of isourea ethers and a study of their physical and chemical properties. The compounds are of special interest because they contain both the amidine and imido ether groups. The presence of these two groups so modifies the compounds that they do not show a number of the characteristic reactions of imido ethers. The conclusion is drawn that the chemical behavior of the isoureas depends in a marked degree on the nature of the radicles present. The great number of facts presented makes a brief review of the paper impossible.

On the Rearrangement of Imido Esters. BY H. L. WHEELER AND T. B. JOHNSON. *Am. Chem. J.*, 21, 185–193.—When silver formamide suspended in ether was heated in an open vessel with ethyl iodide, ethyl phenylimidoformate,  $HC\begin{smallmatrix}\diagup NC_6H_5 \\ \diagdown OC_2H_5\end{smallmatrix}$, was obtained. When, however, the silver salt of the amide and an excess of ethyl iodide were heated in a sealed tube at 100°, the entire reaction-product was N-ethylformanilide,

$$(C_2H_5)(C_6H_5)N.CH : O.$$

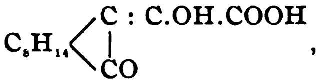
This tautomeric reaction of the silver salt is remarkable, since the difference in conditions in the two experiments is so small; and it shows clearly that synthesis cannot be relied upon as positive evidence in deciding structure. The best explanation of the facts is given by assuming the formation of an intermediate addition-product which can break down in two ways with the elimination of ethyl iodide. A rearrangement was shown also to take place with benzimidoethyl ester, which was converted into ethyl benzamide when heated with ethyl iodide at 100°.

Reaction of Orthodiazobenzoic Acid with Sulphurous Acid and Copper Powder. By W. E. Henderson. *Am. Chem. J.*, 21, 206–210.—In order to test the statement made in text-books and chemical dictionaries that sulphonic acids are formed by the action of sulphurous acid on diazo compounds in the presence of copper powder, the decomposition of *o*-diazobenzoic acid sulphate under these conditions was studied. A reaction took place readily in the cold without the formation of any tarry products, and a yield of 50 per cent. of the theoretical of dithiosalicylic acid was obtained. Copper went into solution as the reaction proceeded, forming a mixture of cuprous and cupric salts, and a part of the sulphurous acid was oxidized to sulphuric acid. The reducing power of the sulphurous acid probably prevented the formation of a sulphuric acid. As the thio acid yields *o*-sulphobenzoic acid on oxidation the reaction may be of value in the preparation of sulphonic acids.

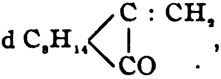
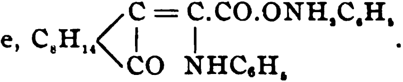
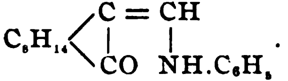
Direct Nitration of the Paraffins. By R. A. Worstall. *Am. Chem. J.*, 21, 210–218.—The author has repeated his study of the nitration of the paraffins by the method already described (*this Rev.*, 4, 87), and has extended the investigation to a number of higher paraffins. The yields of nitro and dinitro compounds from hexane were 6 and 4 per cent. respectively; from heptane, 16 and 24 per cent.; from octane, 17.5 and 25 per cent.; from nonane, 22 and 48 per cent. From decane about 35 per cent. of nitrodecane was obtained when the hydrocarbon was heated with dilute acid (sp. gr. 1.08), which was found to yield the best results. This nitro compound and the derivative of nonane were separated from the unchanged hydrocarbon by conversion into sodium derivatives and subsequent treatment of the latter with carbon dioxide. Hendecane and dodecane gave small yields of mononitro derivatives. After 75 per cent. of the original hydrocarbons had been converted into nitration and oxidation-products, the residual paraffins, when boiled with nitric acid, still gave as oxidation-products acetic, succinic, oxalic, and carbonic acids. This fact seems to show that these acids are not due to the oxidation of naphthenes or other foreign hydrocarbons, as has been claimed by other observers.

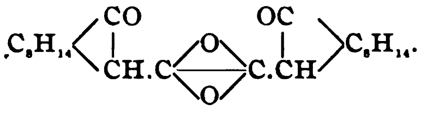
Higher Primary Nitroparaffins. By R. A. Worstall. *Am. Chem. J.*, 21, 218–238.—The properties of the nitro compounds mentioned in the preceding review are described fully in this paper. They were converted into amines and sodium derivatives, and from the latter compounds bromnitro derivatives were prepared. The nitro compounds were shown to be primary by the action of hydrochloric acid, which converted them into the corresponding fatty acids.

The Action of Ethylic Oxalate on Camphor. IV. By J. Bishop Tingle and Alfred Tingle. *Am. Chem. J.*, 21, 238–261.—By heating aniline with camphoroxalic acid,

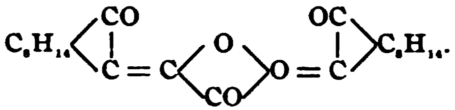


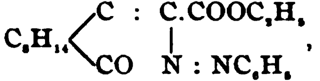
$$C_8H_{14}\left\langle\begin{array}{l} C : C.OH.COOH \\ | \\ CO \end{array}\right. ,$$

three compounds are formed, by varying the temperature of the reaction. These may be considered as derivatives of the hypothetical compound  $C_8H_{14}\left\langle\begin{array}{l} C : CH_2 \\ | \\ CO \end{array}\right.$, to which the name camphoformene is assigned. The following formulas for the compounds are deduced from their reactions: When the two substances are heated at 100° the resulting compound is aniline phenylcamphoformeneaminecarboxylate,  $C_8H_{14}\left\langle\begin{array}{ll} C = & C.CO.ONH_3C_6H_5 \\ | & | \\ CO & NHC_6H_5 \end{array}\right.$. By gentle heat or dilute acids this compound is converted into the corresponding acid, the aniline being split off from the carboxyl group. At 130° aniline and camphoroxalic acid give phenylcamphoformeneamine,  $C_8H_{14}\left\langle\begin{array}{ll} C = & CH \\ | & | \\ CO & NH.C_6H_5 \end{array}\right.$. By the action of benzoyl chloride or acetic anhydride on camphoroxalic acid, a substance is formed which is not changed by boiling sodium hydroxide, bromine in chloroform solution, or hydroxylamine. The compound is therefore probably not an anhydride, as was at first suggested, and the following formula is offered provisionally:



When camphoroxalic acid was boiled with acetic anhydride, a compound, in addition to the above and acetylcamphoroxalic acid, was obtained. The formula which explains its reactions best is as follows:

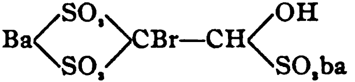


When ethyl camphoroxalate is heated at 130° with aniline the product formed is phenylcamphoformeneaminecarboxylic anilide and not oxanilide, as stated in an earlier paper. By oxidizing ethyl camphoroxalate phenylhydrazide, ethyl camphoroxalate azobenzene,  $C_8H_{14}\left\langle\begin{array}{ll}C & : C.COOC_2H_5\\ & \;| \\ CO & N : NC_6H_5\end{array}\right.$, was obtained. Attempts to condense camphor with diethyl pyrotartrate and with ethyl oxalacetate were made in hopes of getting two isomers in each case; but no well-defined products could be isolated. Further work on the physiological action of camphoroxalic acid shows that when injected intravenously to the extent of 0.241 gram per kilo of body weight, it is practically without effect.

On a Liquid Acetylene Diiodide. BY EDWARD H. KEISER. *Am. Chem. J.*, 21, 261–265.—When acetylene was passed over iodine heated to 140°–160° a slow absorption took place, and the resulting reaction-product consisted of a mixture of an oil and crystals. The crystals were the ordinary acetylene diiodide. The oil, after purification by repeated freezing and liquefaction, had a definite melting-point and boiling-point, and was shown to have the composition $C_2H_2I_2$ by an analysis and a molecular weight determination. Since the liquid acetylene diiodide changes into the solid variety by standing in contact with hydriodic acid, and since it is very stable in the air, whereas the compounds $CH_2{=}CCl_2$ and $CH_2{=}CBr_2$ readily absorb oxygen, it is concluded that it is a stereoisomer of the solid diiodide.

A Simple Color Reaction for Methyl Alcohol. BY S. P. MULLIKEN AND H. SCUDDER. *Am. Chem. J.*, 21, 266–271.—By means of the following test the presence of one part of methyl alcohol in 10,000 parts of water or in 5 parts of ethyl alcohol can be readily shown. A hot copper spiral, which has been superficially oxidized, is dipped into the aqueous solution of the alcohol, one drop of a 0.5 per cent. solution of resorcin is added to the weak formic aldehyde solution thus formed, and the mixture is then poured slowly upon concentrated sulphuric acid. The presence of methyl alcohol is indicated by the appearance of a pure rose-red zone at the line separating the denser and lighter layers. In and above this colored band is suspended a white or pinkish coagulum, which, after long standing, increases notably in color intensity, and finally separates and rises in purplish-red flocks. The test was applied to a large number of substances. The only other compounds studied which give colorations in the least resembling that caused by methyl alcohol, are secondary and tertiary butyl alcohols, dimethylethylcarbinol, and formic acid. With these compounds, however, no confusion need arise for the coloring-matter does not separate and rise to the surface in solid flakes.

Reactions for the Detection of the Nitro Group. BY S. P. MULLIKEN AND E. R. BARKER. *Am. Chem. J.*, 21, 271–276.—The first test described depends on the fact that all nitro compounds when dissolved in dilute alcohol are reduced, in the presence of calcium chloride, by zinc dust to hydroxylamines. The test is applied by dissolving three drops of the nitro body in 3 cc. of 50 per cent. alcohol, adding five drops of a 10 per cent. solution of calcium chloride, a small amount of zinc dust, and heating till violent boiling begins. The presence of a hydroxylamine derivative in the filtrate from the reaction mixture is shown by pouring a few drops of the clear liquid into a strongly ammoniacal solution of silver nitrate in dilute alcohol. The only important classes of nitrogenous compounds which do not reduce ammoniacal silver nitrate in the cold but which effect the reduction after treatment with zinc dust are nitroso, azo, and azoxy bodies. The second test depends on the fact that nitro compounds in the presence of iron and hydrochloric acid oxidize a mixture of equal parts of aniline, *o*-toluidine, and *p*-toluidine to rosaniline. Three drops of the nitro compound are boiled three minutes with 2 cc. of the above mixture, 2 cc. of distilled water, 2 cc. of concentrated hydrochloric acid, and 1 gram of iron filings. A few drops of the reaction-product are poured into dilute acetic acid in order to bring out the clear magenta color. The test is not very successful with trinitro derivatives, and is given by all compounds which contain oxygen linked to nitrogen. Iodoso- and iodobenzene give purplish-red solutions.

Aliphatic Sulphonic Acids. III.—(1) Bromethylenesulphonic Acid. BY ELMER P. KOHLER. *Am. Chem. J.*, 21, 339–370.—When bromine reacts with ethylenesulphonic acid dissolved in water, fuming hydrobromic acid, or glacial acetic acid, the first result is the substitution of bromine for the α-hydrogen atom, which takes place at 0°. The (1)-bromethylenesulphonic acid so obtained is extremely unstable. When a moderately concentrated solution of the acid is heated to boiling and neutralized with a soluble carbonate, from 35 to 50 per cent. of it is decomposed—the bromine and sulphoxyl grouping being split off as bromide and sulphite. If an equally strong solution of the potassium salt is boiled with the same carbonate, there is a rapid addition of water but no elimination of sulphite. Nascent hydrogen replaces the bromine in bromethylenesulphonic acid with hydrogen, potassium hydroxide with hydroxyl, and mercuric chloride with chlorine, but the acid does not lend itself to double decomposition, and it is impossible to link two molecules by eliminating the halogen by silver. (1)-Bromethylenesulphonic acid differs from the analogous carbonic acids in that, like ethylenesulphonic acid, it shows no tendency to combine with two atoms of the same kind or with two similar groups. Nascent hydrogen only replaces the bromine with hydrogen; and bromine, chlorine, and hypochlorous acid oxidize it in the cold. On the other hand, it combines with dissimilar atoms or groups far more readily than unsaturated carbonic acids. Water, hydrobromic acid, sulphuric acid, acetic acid, and acid sulphites are all slowly taken up in the cold. In all these cases the negative component of the molecule goes to the (2)-position. The (1,2)-oxyethanesulphonic acid obtained in this way is bromisethionic acid. A comparison of it with isethionic acid shows an important difference in the formation of anhydrides and in the behavior towards oxidizing agents. Where isethionates are heated they lose a molecule of water for two molecules of salt and pass into diisethionates. The salts of the brom-acid behave in the same way, but they are also capable of forming anhydrides from one molecule of salt. With potassium permanganate isethionates always give stable sulphoacetates. The same oxidizing agent completely destroys brom-isethionates, the products being carbon dioxide, water, hydrobromic acid, and sulphuric acid. Bromine, chlorine, and hypochlorous acid act in the same way on the ,brom acid, whereas nitric acid gives oxalic acid, silver oxide gives glycolic acid, and barium manganate which is kept neutral with a current of carbon dioxide gives bromsulphoacetic acid. (1,2)-Dihalogen ethanesulphonic acids were obtained by the action of phosphorus pentachloride on bromoxyethanesulphonic acid, and by the addition of hydrobromic acid to bromethylenesulphonic acid. The salts of these acids are quite stable. By prolonged boiling with water, alkaline carbonates, acetates, or silver oxide, the (2)-halogen can be completely replaced by hydroxyl, while the (1)-halogen and the sulphonic acid group are left intact. The alkalies and barium hydroxide instantly attack the (1)-halogen in the cold, splitting off halogen and the sulphonic acid group, and leaving aldehydes or their polymeric products. With zinc or magnesium both of the halogen atoms can be readily eliminated, leaving an unsaturated acid. Bromethylenesulphonic acid unites with one molecule of sulphuric acid at 80°, forming bromethylenedisulphonic acid. If the barium salt of the acid is heated with a large excess of sulphuric acid at 125° a salt of the following composition is obtained :  $Ba\left<\begin{matrix}SO_3\\SO_3\end{matrix}\right>CBr—CH\left<\begin{matrix}OH\\SO_3ba\end{matrix}\right.$ $.2H_2O$. The acid is a bromine substitution-product of an acid which has already been obtained by the action of acid sulphites on chloral.

On the Hydrolysis of Acid Amides. By Ira Remsen. *Am. Chem. J.*, 21, 281–284.—This paper is an introduction to one that follows by E. E. Reid (see next review), and points out the effect that a group has on another in the ortho position to it. The fact that *p*-sulphaminebenzoic acid is not acted upon when boiled with dilute hydrochloric acid, whereas benzoic sulphinide is first converted into the corresponding ortho acid and then into the acid ammonium salt of *o*-sulphobenzoic acid by the same reagent, led to a systematic study of the hydrolysis of acid amides.

Experiments on the Hydrolysis of Acid Amides. By E. Emmet Reid. *Am. Chem. J.*, 21, 284–349.—The rate of hydrolysis of the amides studied was determined by drawing off samples of the solutions in which the hydrolysis was being effected by dilute acids or alkalies at definite intervals, and estimating the nitrogen present in the form of ammonia and that in the unchanged amide. Freshly precipitated magnesium hydroxide proved to be an excellent reagent to distinguish between the two forms of nitrogen. It readily set free ammonia from the ammonium salt, but did not affect the amide. After the ammonia had been distilled off sodium hydroxide was added and the nitrogen in the amide was determined. The experimental details were carefully worked out, and consequently very trustworthy results were obtained. Twenty-two amides were studied, which included the nitro, chlor, brom, iod, hydroxy, amido, methoxy, and ethoxy derivatives of benzoic acids. The results obtained with the meta- and para-substituted benzamides go to show that groups in these positions usually exercise some, though not a very marked, retarding influence on the rate of hydrolysis. The rate does not vary regularly with the change in molecular weight. The nitro group in the para position causes a very marked increase in the speed of hydrolysis. The experiments with the ortho-substituted benzamides all show that groups in this position exert a remarkable protective influence on the amide group, the reaction-constant for the ortho acids being roughly about one-tenth that of the meta acids. With similar groups this influence varies roughly with the weight of the group, but otherwise it seems to depend more upon the nature of the group than its weight. Methyl protects far better than chlorine or even than the methoxy group. The nitro group is remarkable in its protective power, being twice as efficient as iodine. The methoxy and ethoxy groups have far less effect than hydroxyl.

Emetine Octoiodide and the Extraction and Estimation of Alkaloids Generally. By H. M. Gordin and A. B. Prescott. *J. Am. Chem. Soc.*, **21**, 231–239.—A detailed description of a new method of extraction of alkaloids from drugs, and directions for applying the authors' volumetric method for their estimation are given fully. By pouring an acidulated solution of emetine into an excess of iodine dissolved in potassium iodide, a periodide was precipitated which probably had the formula $C_{28}H_{40}N_2O_5.HI.I_7$.

Coumarin and Vanillin, Their Separation, Estimation, and Identification in Commercial-Flavoring Extracts. By William H. Hess and Albert B. Prescott. *J. Am. Chem. Soc.*, **21**, 256-259.—Coumarin and vanillin are separated from an aqueous solution by extraction with ether which is then shaken with dilute ammonia. The coumarin remains dissolved in the ether while the vanillin goes into solution in the ammonia, from which it can be separated by means of dilute acid.

The Oxidation of Formic Aldehyde by Hydrogen Peroxide. By J. H. Kastle and A. S. Loevenhart. *J. Am. Chem. Soc.*, **21**, 262–276.—The effect of temperature, sunlight, acids, and bases on the reaction stated in the title was studied. The rate of the reaction increases very rapidly with rise in temperature. The accelerating effect of light is greatest at low temperatures, gradually diminishing with increasing temperature until at about 90° the effect disappears. The effect of acids is to increase the speed of the reaction but not to such an extent as has been observed in the case of other oxidation reactions which have been studied. Bases cause the oxidation to take place so rapidly that the reaction could be studied at ordinary temperatures only.

Upon the Action of Sulphuric Acid on Thymol, III. By James H. Stebbins. *J. Am. Chem. Soc.*, **21**, 276–281.—The principal product of the action of 66° sulphuric acid on thymol, at the temperature of the water-bath, was thymol-*p*-sulphonic acid. A very small amount of a second compound, which was probably a disulphonic acid, was also obtained.

Observations on Derivatives of Aconitic Acid. By D. C. Hanna and Edgar F. Smith. *J. Am. Chem. Soc.*, **21**, 381–383.—By distilling 90 grams of aconitic acid with phosphorus trisulphide about 0.7 gram thiophtene was obtained. Triethyl aconitic ester was produced by heating triethyl citric ester with phosphorus trichloride.

[Contribution from the Massachusetts Institute of Technology.]

REVIEW OF AMERICAN CHEMICAL RESEARCH.

Vol. V. No. 8.

Arthur A. Noyes, Editor.
Reviewers: Analytical Chemistry, H. P. Talbot and W. H. Walker; Biological Chemistry, A. G. Woodman; Carbohydrates, G. W. Rolfe; General Chemistry, A. A. Noyes; Geological and Mineralogical Chemistry, W. O. Crosby and M. L. Fuller; Inorganic Chemistry, Henry Fay; Metallurgical Chemistry and Assaying, H. O. Hofman; Organic Chemistry, J. F. Norris; Physical Chemistry, H. M. Goodwin; Sanitary Chemistry, E. H. Richards; Technical Chemistry, A. H. Gill and F. H. Thorp.

GEOLOGICAL AND MINERALOGICAL CHEMISTRY.

M. L. Fuller, Reviewer.

Geology of Certain Counties of Iowa. By A. G. Leonard, Samuel Calvin, and H. Foster Bain. *Iowa Geol. Survey, Ann. Rep.*, 8, 51–366.—The physiography, stratigraphy, and geological structure of each county is described, and a discussion is given of the economic products, accompanied by a number of analyses.

Properties and Tests of Iowa Building Stones. By H. Foster Bain. *Iowa Geol. Survey, Ann. Rep.*, 8, 367–416.

On the Phenocrysts of Intrusive Igneous Rocks. By L. V. Pirsson. *Am. J. Sci.*, 157, 271–280.—The objections to the hypothesis of an intratelluric origin of the phenocrysts are discussed, and evidence pointing to an origin by crystallization "in place" is presented. The supposed manner in which the development takes place is as follows: As the temperature of an intruded aqueous magma falls, centers of crystallization are set up, the intervals of crystallization of the component minerals becoming progressively shorter as the magma becomes viscous from the escape of the water-vapor. Thus, while the earlier, or ferro-magnesian, components may reach considerable size, the crystals of the later components are comparatively small. In the case of recurrent phenocrysts it is supposed that the most abundant components tend to set up centers of crystallization before their normal periods, the rest of the process continuing as before.

On the Occurrence, Origin, and Chemical Composition of Chromite. By J. H. Pratt. *Am. J. Sci.*, 157, 281–286.—The usual mode of occurrence of the chromite of North Carolina is in the form of rounded masses of varying proportions in the peridotite near its contact with the inclosing gneiss. Its basic character is an indication of its insolubility in the peridotite magma; hence it would have been among the first of the minerals to solidify. Its relation to the inclosing rock confirms this view. With two exceptions, all analyses known show the presence of magnesium and aluminum, and the author concludes that chromite is really a combination of the three isomorphous molecules, $FeO.Cr_2O_3$, $MgO.Cr_2O_3$, and $MgO.Al_2O_3$. The $MgO.Al_2O_3$ is represented by the mineral spinel, and the discovery of $MgO.Cr_2O_3$ as a definite mineral may be expected.

Some Rock-forming Biotites and Amphiboles. By H. W. Turner. Analyses by W. F. Hillebrand, H. N. Stokes, and William Valentine. *Am. J. Sci.*, 157, 294–298.—The paper includes descriptions and very complete analyses of biotite from granite, quartz-monzonite, and gneiss from the Sierra Nevada region, and of the amphibole of gabbro and quartz-monzonite from the same locality. Complete analyses of most of the rocks are also given. The work was executed in the laboratory of the U. S. Geol. Survey, the object being to furnish a basis for calculating the molecular composition of the rocks in question.

On the Occurrence of Paleotrochis in Volcanic Rocks in Mexico. By Henry S. Williams. *Am. J. Sci.*, 157, 335–336. —More or less regularly striated biconical forms resembling the supposed coral Paleotrochis of Emmons was found by Alfred Dugès in the volcanic rocks of an old eroded cone northeast of Guanajuato in the Santa Rosa Mountains. The explanation is suggested that in the upward passage of superheated siliceous waters through the rock a point might be reached where a sudden loosening of the texture would permit a rapid upward radiation of the heat, while below the point the temperature would remain nearly constant for long periods. Deposition would take place wherever a cavity existed, but the supply of silica would be furnished only as it was abstracted by solidification. It is considered that the cavity would be increased in size by the crystallization, and that "the accretion-surface would increase with the lengthening of the cone by the separation of the apices of the cones, consolidation taking place at the point of meeting of the solidified silica with the water, and the water reaching that point slowly."

Origin of Paleotrochis. By J. S. Diller. *Am. J. Sci.*, 157, 337–342.—A summary of the reviews of previous writers, and descriptions of both the macroscopic and microscopic characters of specimens from Mexico (see preceding review), and from the San Christian Gold Mine of North Carolina are given in some detail. In both cases the Paleotrochis occurred in igneous rock, the analysis of the North Carolina type, which is given in full, indicating a rhyolite. The more perfect Paleotrochis are composed of granular quartz and were deposited within the more or less elongated spherulites with which the rock abounds, but whether this deposition followed soon after that of the spherulites in the course of consolidation, or took place in hollow spherulites (lithophysae), or were the result of subsequent alteration, is not clear. The biconical forms suggest that they may have originated as two spherulitic sectors, of which the apices were the centers from which the growth started.

On the Association of Argillaceous Rocks with Quartz Veins in the Region of Diamantina, Brazil. By Orville A. Derby. *Am. J. Sci.*, 157, 343–356.—The paper discusses in detail the characters and probable origin of certain more or less strongly decomposed rocks of the Diamantina district. An exhaustive analysis of a cyanitic schist from the region in question, made by W. F. Hillebrand, is included.

Goldschmidtite, a New Mineral. By William H. Hobbs. *Am. J. Sci.*, 157, 357–364.—The new mineral, to which the name of goldschmidtite has been given by the author, is a brittle, silver-white substance, having a hardness of about 2 and a specific gravity of 8.6. It is found in the form of minute columnar monoclinic crystals attached to the chalcedonic coatings of the fragments of a brecciated igneous rock of the acid type occurring at the Gold Dollar Mine, Arequa Gulch, Cripple Creek. The analysis shows the presence of 31.41 per cent. of gold, 8.90 per cent. silver, and 59.64 per cent. tellurium, corresponding to the formula Au_2AgTe_6, and giving it a position intermediate between calaverite and sylvanite. Twenty-two crystal forms were recognized, ten of which are also recognized in sylvanite, to which the new mineral is most closely allied.

On a Hydromica from New Jersey. By F. W. Clarke and N. H. Darton. *Am. J. Sci.*, 157, 365–366.—This golden-bronze mineral, which differs widely from any hitherto-described mica, is found mainly as thin coatings in veins of calcite adjacent to the diabase wall rock at Rocky Hill, N. J. The analysis indicates an orthosilicate of the formula

$$(KH)_{68}(MgFe)_{24}(AlFe)_{51}(SiO_4)_{67}.28H_2O,$$

pointing to a mixture of muscovitic ($R'''(SiO_4)_3R'_3$) and phlogopitic ($R'''(SiO_4)_3R''_3H_3.3H_2O$) molecules in the ratio of 9 to 5.

METALLURGICAL CHEMISTRY.

H. O. HOFMAN, REVIEWER.

Porous Castings and Occluded Gases. *J. Am. Foundrymen's Assoc.*, 6, 18.—The paper discusses the effects of hydrogen and sulphur dioxide in castings of brasses and bronzes and of carbon monoxide in castings of steel and suggests some methods for getting rid of occluded gases.

Phosphor Bronze—a Description of Its Characteristics and Methods of Manufacture. BY L. S. SMITH. *Am. Eng. and R. R. J.*, 73, 147–149.—The author distinguishes high tensile bronze, the alloy of copper, tin, and phosphorus, and bearing bronze, the above alloy to which lead has been added. He gives a brief history of the manufacture, the compositions and specifications of the alloys, discusses the action of phosphorus in bronze, the foundry treatment of the alloy, and the method of introducing the phosphorus.

The Progress of Metallography in 1898. BY A. SAUVEUR. *The Metallographist*, 2, 1–8.

The Microstructure of Bearing Metals. BY G. H. CLAMER. *J. Franklin Inst.*, 146, 138–153.—The two leading requirements of bearing alloys, *viz.*, good antifriction and good bearing qualities, depend not only upon the chemical composition but also upon the structure of the alloy. The author discusses three white-metal alloys (having the composition, Pb, 80.00; Sn, 4.75; Sb, 15.00; Bi, 0.25: Pb, 70.00; Sn, 10; Sb, 20: and Sn, 80.00; Sb, 10.00; Cu, 10.00), miscellaneous alloys (with over 60 per cent. of copper, the rest consisting of Zn, Sn, Pb, Sb, etc.), a copper-tin alloy (composed of 7 parts Cu to one part Sn once used in railroad cars, but now abandoned), and phosphor bronze (Cu, 78.72; Pb, 9.89; Sn, 10.58; P, 1.04, which, after remelting, gave Cu, 80.39; Pb, 8.35; Sn, 10.40; P, 0.87), with copper-tin-lead alloys, the last two being commonly used for locomotive journal bearings.

A Study of the Microstructure of Bronzes. BY A. E. OUTERBRIDGE, JR. *J. Franklin Inst.*, 147, 18–31.—The author having examined microscopically a large number of specimens of bronze cut from small castings found that the appearance of the etched surfaces varied greatly with the length of time that they had been exposed to the acid and suggests that a uniform system should be adopted so as to permit satisfactory comparisons.

The Reduction Works for Silver Ores at Aduana, Sonora, Mexico. By M. T. Armas. *J. Franklin Inst.*, **146**, 293–302; 349–357.—The paper is a description of the metallurgical treatment of the complex ores at the works. The ores are of four kinds: 1. Smelting ores, argentiferous gray copper with some blende and galena: SiO_2, 36.2; Cu, 11.4; Pb, 9.8; CaO, 1.8; Fe, 2.1; S, 10.8; Zn, 11.5; Sb, 6.3; As, 5.2; As_2O_3, 1.2; Ag, 2.4. 2. Black ore, a complex mixture of galena, blende, copper glance, chalcopyrite and sulphantimonides and arsenides with more or less silver: SiO_2, 41.4; Cu, 11.4; Pb, 9.8; CaO, 0.8; Fe, 3.1; S, 11.3; Zn, 13.2; Sb, 4.2; As, 3.3; Ag, 1.07. Also plomores, similar to black ore, only richer in lead: SiO_2, 33.2-33.0; Pb, 30.6-28.1; Cu, 6.8-8.0; Zn, 11.5-16.3; S, 12.2-11.1; Sb, 2.1-1.2; As, 2.6-0.9; Ag, 0.60-0.88. 3. Milling ores, siliceous, especially rich in blende: SiO_2, 66.20; Al_2O_3, 0.30; Fe, 4.00; CaO, 1.80; MgO, trace; Zn, 9.35; Cu, 3.82; S, 6.76; Pb, 4.60; Sb, 1.20; As, 0.84; Ag, 0.22 (ranging from 48 to 72 oz. per ton). 4. Concentrating ores, mixed sulphides assaying 23 oz. silver per ton. The concentrates obtained by wet-stamping and passing over Frue vanners with corrugated and plane belts, have the following composition: SiO_2, 12.0; Pb, 19.1; Cu, 12.1; S, 22.2; Zn, 21.0; Al_2O_3, 1.2; CaO, 0.9; Sb, 3.2; As, 4.1; Fe, 2.9. There are two methods of treatment, chlorodizing roasting followed by leaching with hypo salt and matting with incidental liberation of lead to be cupelled and serving to work up the sulphides from the leaching plant. The hand reverberatory furnace used for chlorodizing has four hearths, 4×9 feet, the ore charge of 1200 lbs. remains 2-3 hours on a hearth, the salt (4–8 per cent.) is added on the last hearth two hours before drawing. An addition of one per cent. pyrite greatly facilitates the chlorodizing roast of ores low in sulphur, the chloridation assay giving 97.5 per cent. soluble silver. The 9 leaching tanks of the plant are 20 feet in diameter and 5 feet deep; they have a gravel filter one foot deep, and hold each 37–45 tons of ore. In base-metal leaching the wash-water is at first admitted from below and the soluble salts are removed in 15–24 hours. The wash-water is freed from copper and silver by being passed over matte, the copper content of which is raised thereby from 35 to 40 per cent. The silver solvent is a mixture of sodium and calcium hyposulphite of a strength of 0.55–0.60 per cent., the rate of leaching is $2\frac{1}{8}$ in., the average time required for a charge 14 days, and the assay of the tailings 2.57 oz. silver per ton. The three precipitating tanks are 12×6 feet and have each a capacity of 678 cu. ft. The precipitant is calcium polysulphide. It is prepared by filling one tank (8 ft. in diameter by $6\frac{1}{2}$ feet in height) 1 foot deep with water, boiling with live steam, adding first burnt lime (100) then sulphur (70), boiling for 5–6 hours, and decanting the solution (6213 liters) with a storage tank. The residue is again treated with water and steam, but a smaller quantity of reagents (lime 79: sulphur 56) is added, giving a second solution of the same strength and quantity as the first. The residue from the second boiling is discharged onto the sand filter of a second vat (6 ft. diameter by 6 ft. in height) and allowed to dry. It is then exposed to the oxidizing action of the air and leached with water, giving a calcium hyposulphite solution of a strength of 6.2 per cent. The sulphides from the precipitating vats (containing 24 per cent. silver and 31 per cent. sulphur) are treated with lime and boiled to extract the free sulphur before they are worked on the lead-bath of an English cupelling furnace. Treating, for example, 11.75 lbs. sulphides with lime and steam for 1 hour gave 54 liters calcium polysulphide of 2° B., containing 5.380 grams sulphur per liter. The concentrates are formed into bricks, 8×3×1 inches, with a clay-like mass of weathered rhyolite (SiO_2, 54.0; Al_2O_3, 18.6; Fe_2O_3, 15.4; CaO, 2.2; H_2O, 8.6) and charcoal fines, in the proportion, clay 13 per cent., charcoal 8 per cent., and concentrates 79 per cent. The bricks are air-dried, carefully stall-roasted and smelted for a matte to be concentrated to 40 per cent. copper by retreatment. The argentiferous lead which separates out is cupelled in an English cupelling furnace. The test of the cupel, 46×59 inches, is filled with 1579 lbs. of a mixture of 100 limestone (SiO_2, 10.0; Al_2O_3, 0.8; Fe_2O_3, 3.4; CaO, 47.0; H_2O, 1.8; CO_2, 37.0) and 46 weathered rhyolite (SiO_2, 54.0; Al_2O_3, 18.6; Fe_2O_3, 15.4; CaO, 2.2; H_2O, 8.1) crushed to pass a 4-mesh sieve. It holds 3500 lbs. lead; the blast-pressure is 7 oz. per square inch; the loss in silver in cupelling is only 0.7 per cent., the silver bars being brought to a fineness of 990.

How to Build and Operate an Arrastra. By E. L. Ballou. *Min. Sci. Press*, **78**, 32–34.—This is an illustrated description of the method of erecting a water-power arrastra and of the mode of operating.

The Arrastra and the Stamp Mill. By M. F. Leech. *Eng. Min. J.*, **67**, 466.—The arrastra has always been considered a primitive gold amalgamating apparatus suited for the prospector or the small operator. If the ore is crushed sufficiently fine before it is charged into an arrastra, the working capacity of the latter is greatly increased. Thus at Silver City, Idaho, a 5-feet arrastra treats in 24 hours 5 tons of stamped ore. Three 10-feet arrastras set tandem could treat in 24 hours 30 tons average ore rolled to pass a 10-mesh sieve. Setting arrastras in tandem increases the crushing capacity because the drags and their motion can be adapted to the different kinds of work that the three successive mills have to do. The tailings from such a tandem mill can be readily run to a concentrating machine by thinning the pulp in the last arrastra. If roasted ores are to be amalgamated, a mechanical roaster can discharge continuously hot ore into the first arrastra and any imperfection in the roast be corrected by concentrating after the pulp leaves the third arrastra.

Temperature of Battery Water. By W. F. Drake. *Min. Sci. Press*, 77, 556.—The author found that if in milling gold ore the temperature of the battery water went below 50° F. it had to be heated, as otherwise the yield in gold would diminish, the best results being obtained with water of 80°-90° F. A smaller amount of quicksilver was then found to be necessary than when the water was cooler.

Temperature of Battery Water. By Mine Superintendent. *Min. Sci. Press*, 77, 505.—It is usually admitted that a temperature of 60°–70° F. is best for the water used in battery amalgamation of gold ores, although some millmen claim that it is just as well to have it ice-cold. The paper is a record of some instances in which water above 70° F. gave better results than when below. Thus, in one mill the saving of gold was 90 per cent. with water at 80° F., and only 80 per cent. when at 60° F. The warmer water seemed, however, to increase the greenish film of oxidized copper on the plates, but the squeezed amalgam was richer in gold. At the Virtue mine, Baker City, Ore., battery water at 90° F. had to be used; the saving of gold was very high, 90 per cent. by amalgamation with ore running $12–$16 in gold; less quicksilver was used than with cold water, in fact the amalgam was kept so hard as to have a frosty appearance. This was found to be necessary to prevent any quicksilver from draining off, which probably is the greatest objection to the use of warm water.

The Utica Mine Chlorination Plant. By T. N. Smith. *Eng. Min. J.*, 57, 467–468.—The ore treated is a concentrate containing 33 per cent. iron, 37 per cent. sulphur, and 30 per cent. calcium carbonate. It is roasted in six long-hearth continuous hand-reverberatory furnaces, 12×80 feet. A furnace holds 4 charges, each weighing 2400 lbs. with 10 per cent. moisture. In the furnace, which has a flat bottom, the charges are kept 2 feet apart. The 30 feet of the hearth near the fire bridge form the finishing hearth. In the rest of the furnace each ore-charge occupies about 15 feet of the length of the hearth. Supposing the finishing hearth to be empty and the sulphur of the charge next to it to be burning, this charge will be spread over the 30 feet of the finishing hearth, the working doors kept open, and no wood burned in the fireplace for about 4 hours. When all the sparks have disappeared, the back half of the charge is moved forward 15 feet and spread over the front half; the fire is started again and kept going for two hours. In the meantime the space of 15 feet made vacant by one-half of the finishing charge is filled by moving down the next following charge, etc. After 2 hours' heating, the finishing charge will have become red-hot and will be drawn, the sulphur of the next following one will have begun to burn when 40 lbs. of salt are added to convert calcium carbonate into chloride and thus reduce later on the consumption of chlorine. When the finished charge has been drawn, the next following one, occupying 15 feet of the finishing hearth, is spread over its entire length of 30 feet. Every 6 hours a charge is drawn and given. The men work in 6-hour shifts, one man working 8 hours to assist in drawing, moving, and charging. A charge of roasted ore, after having cooled, is wetted with 12½ lbs. concentrated sulphuric acid (diluted with 12 per cent. water), mixed and shoveled into a heap in front of a leaching vat. The four leaching vats, made of 2-inch pine, are 8 feet 6 inches in diameter, 3 feet 6 inches high, and have a 6-inch gravel filter. Laths 1½-inch square are placed on the bottom 1 foot apart, across these 6-inch strips, 1 inch apart, next follow flat pieces of rock, then gravel 1 inch in diameter and from 6 to 7 fine sizes of sands; the last one is covered with 4-inch strips used as a shoveling floor, the spaces between them being filled with fine sand. The ore is screened into the vat through a 9-mesh sieve, the gas is admitted for 6–8 hours through three openings in the bottom. The gas is produced in three lead generators, taking together 90 lbs. pyrolusite, 100 lbs. salt, and 200 lbs. concentrated sulphuric acid. After remaining in gas for 48 hours, the ore is leached with water to about fill a settling tank, 8 feet in diameter and 4 feet deep, after which ferrous sulphate will give no reaction for gold; the discharge-hose is now hung up and the tub allowed to stand until next morning, when 1 ton of water is run through, which finishes the leaching. To the gold solution in the settling vat are added 15 lbs. sulphuric acid to separate some sulphates; it is then run into the precipitating vat and the gold precipitated with ferrous sulphate. The gold is given 48 hours for settling, which is assisted by adding 1 oz. of barium chloride, the barium sulphate formed carrying down any float-gold. The extraction of the gold is 90 per cent., its fineness 0.997. Recently liquid chlorine has been substituted for 90 per cent. of the gaseous chlorine, it taking 20 minutes to admit it. The liquid chlorine is received in drums 5 feet long by 10 inches in diameter; a drum weighs 300 lbs., holds 115 lbs. liquid chlorine (under a pressure of 200 lbs.), and replaces 972 lbs. pyrolusite, 1080 lbs. salt, and 2160 lbs. sulphuric acid. The cost of working per ton of concentrates is with gaseous chlorine alone $7.80, with liquid and some gaseous chlorine $6.90.

The Lixiviation of Slimes. By A. James. *Eng. Min. J.*, 67, 378.—The paper makes a comparison between leaching slimes by the use of a filter-press at the Kalgoorie mines, Western Australia, and leaching by circulation of pulp with transfer from vat to vat by means of centrifugal pumps followed by decantation and washing at the Witwatersrand mines, South Africa. In general, it may be said that the filtering process requires less water, but the extraction is less perfect and costs more than the circulation process. With sufficient water, as in the South Africa gold districts, the latter process is the only one used; in the arid region of Kalgoorie the dirth of water has so far made filtering the leading process.

The Electro-Zinc Process, and Experimental Researches Which Led to Its Development. By W. Bettel. *Min. Sci. Press*, 78, 178; 208.—The author describes some experiences that he had in treating fine gold-bearing slimes with potassium cyanide and a filter-press. The slimes containing about 0.3 oz. gold per ton were pulped with a 0.2 per cent. cyanide solution to which potassium permanganate (0.1 lb. per ton of dry slimes) had been added as an oxidizing agent, passed through a Johnson filter-press with 24-inch frame, and then washed. The extraction of gold based on the assay of the tailings was 98.2 per cent. The author has improved the ordinary Johnson press so that by a single movement the different plates are separated a sufficient distance to allow a rapid removal of the slime cakes. In searching for means to clarify dilute cyanide solutions from slimes so as to be able to decant them, the author found that hydroxides which form insoluble compounds with silica, such as those of calcium, strontium, and barium, worked satisfactorily. In large-scale work, of course, only calcium hydroxide is available. In following this method of clarifying, he found that float-gold (Zsigmondi's colloidal gold) was carried down with the slimes, *i. e.*, gold so finely divided that when prepared chemically it would give water a pink color. Tests showed that a solution which, after passing through Pasteur-Chamberland filtering candles, would assay 1 grain gold per ton would, after clarifying with calcium hydroxide, assay only 1½ grains. In order to determine by a quick assay the value of gold in dilute cyanide solutions, the author took samples of from 200 to 1000 cc., shook them for 20 minutes in stoppered flasks with from 5 to 20 cc. sodium amalgam containing 0.1 per cent. sodium, treated the quicksilver separated from the solution with nitric acid until a small globule remained and parted this carefully. Comparative tests proved that the method was accurate to 98–

95 per cent. with a solution containing 1 oz. to 5 dwts. of gold, to 95–90 per cent., with a solution of 5 to 1 dwt.; and to 90–80 per cent. with a solution of 1 to 0.1 dwt.; with the last solution it was advisable to take 2500 cc. and 10 cc. sodium amalgam. By applying the necessary corrections values were obtained which were accurate within 2 per cent. of the truth. In experimenting on the electrical precipitation of gold from cyanide solutions the author tried sodium amalgam, which worked very well at first, only 1.5 grains gold per ton being left in a solution containing 1 oz. per ton, but the rapid decomposition of water accompanied by the oxidation of the zinc soon rendered the reagent useless for a weak solution. The idea of producing a galvanic couple by coating the usual zinc shavings with copper, lead, bismuth, and silver, respectively, as suggested by Gladstone and Tribe by dipping them into the solutions, was carried out in a 100-ton experimental plant. As long as the solutions were clear and the couples clean, the precipitation was most satisfactory; even charcoal did satisfactory work as long as the hydrogen remained occluded in its pores. After some time, however, the precipitation began to slacken and then to stop, the causes of which were to be found in the combined effects of the oxidation of zinc and its precipitation as hydroxide, carbonate, and complex ferrocyanide, the precipitation of lime as carbonate and the settling out of slimes. The electrical precipitation by local action having proved a failure, the author used an extraneous source of current and a special form of cell. Carbon anodes, either plain or coated with platinum sponge, had to be given up as they soon became disintegrated. Lead in an alkaline solution became coated with a non-adherent oxide and the peroxide of lead plates, as used in accumulators; he did not feel justified in using them on account of difficulty of handling and expense. They are, however, strongly recommended by Andreoli (*this Rev.*, 4, 78). A varnished lead plate finally proved satisfactory for the current of 0.4 amperes per square foot of anode area. The varnish consisted of 1 vol. linseed oil (boiled with litharge), 2 vols. Brunswick black (solution of asphaltum in turpentine) and one-third vol. graphite, and the whole diluted with turpentine to thin the mixture; two coats were required. As a diaphragm 14-oz. cotton duck made waterproof with either tannates or chromates of albumen or gelatine was very satisfactory. In order to make the solution passing by the anodes conductive, 0.02 per cent. carbonate of soda was added; the gold solution passing by the cathode was already a conductor. The cathode zinc shavings were held in cages of perforated sheet-zinc having a perforated central division wall and six trays of similar character, the whole being enclosed in a bag. The precipitating box had 90 compartments, 50 narrow

(4-inch) and canvas-framed for the anodes and 40 wide (13-inch) for the cathode cages. At the head of the box the solution, made alkaline with sodium carbonate, flowed into the anode divisions, the gold solution into the cathode divisions. The current averaged 200 amperes and 6 volts. It is expected that the resistance in future plants may be overcome by 3 volts. The precipitation was satisfactory throughout; the clean-up was made by treatment with sulphuric acid, followed by fusion with alkali fluxes. The author believes that his process will give at least 6 dwts. more profit per ton of slimes than any other.

A Blast-furnace Problem with Zinc. By W. W. Taylor. *Eng. Min. J.*, 67, 469.—The iron ores smelted in western Virginia containing about 0.1 per cent. zinc form hard cadmias at the throat of the furnace and dusty oxides in the stoves, flues, etc. A hard, strong cadmia had the following composition: Zn, 73.00; SiO_2, 2.50; FeO and Al_2O_3, 3.00. With slow driving and a large percentage of fuel, little trouble occurs from the presence of zinc; with hard driving and a low consumption of fuel the zinc accretions near the throat of the furnace have to be removed every few months. It has been found that the cadmias collect especially opposite the down-take; in order to prevent their forming large accretions which greatly disturb the running of the furnace and render their handling difficult when broken off, the gases are drawn off by four flues. The cadmias fill the intervening spaces, their weights rarely exceeding 12 tons.

The Whiting Process for Making Portland Cement. By C. Kirckhoff. *Iron Age*, 63 (No. 10), 9.—The process aims to make Portland cement from the iron blast-furnace slag of the Illinois Steel Co. A plant producing 500 barrels a day having proved successful at the "North Works," another with a daily capacity of 1500–2000 barrels for the "South Works" is being erected. The liquid slag running from a trough is granulated by a stream of water issuing from a nozzle under a pressure of 80 lbs. to the square inch; it is then conveyed to a rotary dryer, thence to Griffin pulverizers, and lastly the dry pulp to Davidson tube-mills. A tube-mill consists of a horizontal cylinder, 4 feet in diameter and 16 feet long and lined with porcelain, making about 27 revolutions per minute. It is filled to half its volume with flint pebbles, 1–2 inches in diameter, which grind up and mix intimately the pulverized slag, burnt lime and other ingredients making up the charge. This is fed through the trunnion at the upper end and discharged at the periphery at the lower end. At least 95 per cent. of the mixture, the finished cement, will pass a screen with 40,000 meshes to the square inch.

Cast Iron. By R. G. G. Moldenke. *The Foundry*, 13, 222-231; 14, 14-16.—The paper gives a general review of the different pig irons used in casting, of the cupola and reverberatory methods of melting, and of the physical and chemical properties of cast iron. Cast iron is defined as an iron carrying over 1½ per cent. silicon, which, after casting, is not subjected to further heat treatment.

The Melting-point of Cast Iron. By R. Moldenke. *J. Am. Foundrymen's Assoc.*, 5, 282–292.—On account of the difficulty of judging the temperatures of melted irons of different chemical compositions by the eye alone (*e. g.*, a ladleful of one iron, appearing as hot as melted steel while in reality it is cooler than one which seems to be dull-red), induced the author to determine the melting temperatures experimentally. He used the LeChatelier pyrometer, modifying it by covering the exposed couple with a fire-clay tip. This can be attached to the iron pipe holding the platinum and platinum-rhodium wires, insulated in this case with asbestos. Using the tip, a correct reading is obtained in 1¾ minutes, when the couple is plunged cold into the liquid metal; if it is first brought to a red-heat this can be done in a few seconds. The melting-points of 73 samples of analyzed pig iron, ferro silicon, silico-spiegel, cast iron, and alloys of steel were determined and tabulated by the author.

Method of Casting Test-bars for the American Foundry Association Testing Committee. By T. D. West. *J. Am. Foundrymen's Assoc.*, 5, 301–305.

The Yard-Grading of Pig Iron. By W. B. Phillips. *J. Am. Foundrymen's Assoc.*, 6, 6–17.—In grading pig iron for foundry purposes according to the appearance of the fracture there are distinguished at present the following 13 classes: Open and close silver-gray irons show a fine silvery luster on a fresh surface, are flaky, have little or no granulation, are weak, and contain 5–6 per cent. silicon. Nos. 1 and 2 soft irons begin to show granulation, have light color, a smooth surface, and a weak fraction, the Si ranges from 3–4 per cent., they are less flaky than silvery irons, less jagged than foundry irons, and darker than silvery irons on account of the graphite they contain. No. 1 foundry is dark, has a granulation that is very open and regular, its crystallization is well marked, and the face is rough to the feel, the Si runs from 2.50–3.00 per cent. No. 2 foundry has the same general character as No. 1, it is closer grained, shows a finer crystallization, and while the color may be the same as in No. 1 it lacks the blackish-gray velvety quality, the Si runs from 2.25–2.50 per cent.; No. 3 foundry with

2.00–2.25 per cent. and No. 4 foundry with 1.75–2.00 per cent. silicon form the transition to gray forge with 1.50–1.75 per cent. This has a pebbled granulation in the center with mottled edges, the face is blistered, pitted and often honeycombed. Mottled iron with 1.25–1.50 per cent. silicon has next to no granulation, but shows a pepper-and-salt appearance on a fresh fracture. Finally, white iron has no granulation whatever, is white but not silvery, the silicon runs from 0.1–0.6 per cent. The author shows how unsatisfactory is the present method of grading, when *e. g.* silvery irons are hardly produced at all and the silicon irons, which formerly analyzed 3–5 per cent., now carry 2–3 per cent. silicon without having changed their appearance correspondingly so as to allow a satisfactory grading by fracture. Grading alone by the silicon content is simple, but unsatisfactory; to it ought to be added a ratio between silicon and combined carbon for soft and foundry irons and the percentage of sulphur as affecting gray forge, mottled, and white irons. This brings the grading nearly to a chemical basis. The use to which a particular pig iron is to be put is indicated by its chemical composition and not by its color, fracture, granulation of fracture, etc. In large works which have uniform ore charges, the outer appearance may serve as a guide, if it is continually checked by work in the chemical laboratory. Retaining the old nomenclature, the author proposes the following six grades, with the understanding that in special cases the percentage of phosphorus be also included:

Kind of iron.	Si.	Comb. C.	S.
Silvery	5–6	0.10–0.30	0.01–0.04
Soft	3–5	0.20–0.60	0.01–0.05
Foundry	2–3	0.30–0.90	0.01–0.07
Gray Forge	1–2	0.40–1.25	0.04–0.09
Mottled	0.6–1	0.50–1.80	0.06–0.11
White	0.1–0.6	1.00–2.50	0.08–0.30

On the Influence of Silicon upon the Heat of Solution of Coke Cast Irons. BY E. D. CAMPBELL AND W. E. HARTMAN. *J. Am. Chem. Soc.*, **20**, 690–695.—The metallurgical interest of this paper lies in the question as to whether the form of silicon in which it is present in No. 1 foundry iron changes when with increase of temperature a blast-furnace produces lighter and lighter irons until silvery or glazed iron is made, which shows such different physical and chemical properties from No. 1 foundry. The conclusions arrived at are that in dissolving iron with 0.1–0.4 per cent. silicon and the carbon nearly all present in the graphitic form, the heat evolved by the oxidation of the silicon is proportional to the amount of silicon present. With low-silicon iron in which the carbon is largely present in the combined state, the heat made sensible by solution is much diminished owing to the heat consumed in decomposing iron-carbon compounds and possibly some compounds of iron, silicon, and carbon, or of carbon and silicon. Since the oxidation of 1 gram silicon evolves 3824 calories, and the maximum of calories evolved in dissolving cast irons in the experiments was 3303 calories, it is evident that the decomposition of the compounds of silicon with iron must consume a large amount of heat. Lastly, ferrosilicon, in which the percentage of silicon is nearly sufficient to correspond to the formula $SiFe_2$ is not decomposed by ammonium copper chloride.

The Allotropic Theory and the Hardening Power of Low-Carbon Steel. BY H. M. HOWE. *The Metallographist*, 2, 77-78.—An answer to Ledebur's discussion of the author's experiments on the hardening of low-carbon steel.

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REVIEW OF AMERICAN CHEMICAL RESEARCH.

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ARTHUR A. NOYES, Editor.

REVIEWERS: Analytical Chemistry, H. P. Talbot and W. H. Walker; Biological Chemistry, A. G. Woodman; Carbohydrates, G. W. Rolfe; General Chemistry, A. A. Noyes; Geological and Mineralogical Chemistry, W. O. Crosby and M. L. Fuller; Inorganic Chemistry, Henry Fay; Metallurgical Chemistry and Assaying, H. O. Hofman; Organic Chemistry, J. F. Norris; Physical Chemistry, H. M. Goodwin; Sanitary Chemistry, E. H. Richards; Technical Chemistry, A. H. Gill and F. H. Thorp.

ANALYTICAL CHEMISTRY.

ULTIMATE ANALYSIS.

W. H. WALKER, REVIEWER.

The Volatilization of the Iron Chlorides in Analysis and the Separation of the Oxides of Iron and Aluminum. BY F. A. GOOCH AND FRANK S. HAVENS. *Am. J. Sci.*, 157, 370–374.—When ferric oxide is submitted to the action of dry hydrochloric acid gas at a temperature of 180°–200°, it volatilizes partially as ferric chloride, but leaves ultimately a crystalline residue of ferrous chloride not volatilized at even 500°. If, however, the oxide be first heated to 450°–500° before the brisk stream of hydrochloric acid gas begins to act, or if the acid contains a little chlorine when it is passed over at 200°, the entire mass of oxide is converted and volatilized without residue. Results of experiments to apply this principle to the separation of the mixed oxides of iron and aluminum are perfectly satisfactory, showing that the separation of the iron oxide is complete at 450°, when the mixed oxides are submitted at once to the action of the gas, or at 200°, when chlorine is mixed with the acid gas.

The Use of Compressed Oxygen in Elementary Organic Analysis and of Soda-lime in the Quantitative Determination of Carbon Dioxide. BY FRANCIS G. BENEDICT AND OLIN F. TOWER. *J. Am. Chem. Soc.*, 21, 389–398.—Inasmuch as oxygen stored under pressure in steel cylinders was found to contain less moisture and carbon dioxide than that made in the ordinary way and used from a gasometer, the author considers the use of the compressed gas an advantage in elementary organic analysis, and describes a piece of apparatus by the use of which the pressure of the gas may be controlled. Freshly prepared soda-lime was found to lose less moisture during absorption of carbon dioxide than potash bulbs.

Determination of Calcium and Magnesium in Ashes. By J. K. Haywood. *J. Am. Chem. Soc.*, 21, 508–511.—Instead of filtering off the basic acetate precipitate containing the iron and phosphoric acid and washing it free from the filtrate in which calcium and magnesium are to be determined, the author finds it sufficiently accurate to filter only an aliquot part of the supernatant liquid and to precipitate the calcium and magnesium from this. Analytical data are given to show the accuracy of the process.

Tests for Boric Acid. By Victor Lenher and J. S. C. Wells. *J. Am. Chem. Soc.*, 21, 417–420.—An experiment described by Newth in his "Chemical Lecture Experiments" for the production of boric ether is applied as a qualitative test for boric acid. It is found more delicate than the usual method of sulphuric acid and alcohol in an evaporating dish. It is carried out as follows: In a test-tube fitted with a cork, through which passes a glass tube drawn out to a jet, are placed the borate, sulphuric acid, and alcohol. The boric ether formed when the mixture is heated burns at the jet with the characteristic flame, copper and barium not interfering with the test. Comparative tests of all the ordinary methods, however, show turmeric paper to be the most sensitive.

The Constitution of the Ammonium Magnesium Phosphate of Analysis. By F. A. Gooch and Martha Austin. *Am. J. Sci.*, 157, 187–198.—The results of this extended investigation show that in determining magnesium by the procedure in ordinary use, the tendency is strong towards too high results, and it is made evident that the error is due to the combined effect of excesses of the precipitant, the ammonium salt, and free ammonia in throwing down a compound of phosphoric acid richer in ammonia and poorer in magnesium than the normal salt, NH_4MgPO_4. This tendency is counteracted, and the consequent error entirely eliminated, by pouring off the supernatant liquid (through the filter subsequently to be used to collect the precipitate) as soon as the precipitate subsides, dissolving the phosphate in the least amount of hydrochloric acid, and after dilution reprecipitating by a faint excess of ammonia. This procedure precipitates the normal salt, which should be washed with faintly ammoniacal water. In the precipitation of a soluble phosphate by magnesium mixture the results are much the same, and the use of strong ammonia (1 : 3) is again shown to be not only unnecessary but disadvantageous. Good results may be expected when the solution of the phosphate containing a moderate excess of a magnesium salt and not more than ten per cent. of ammonium chloride is precipitated by making slightly alkaline, and then washed with slightly alkaline wash-water.

A Modification of Pierce's Method for the Determination of Arsenic in Ores. By J. F. Bennett, Jr. *J. Am. Chem. Soc.*, **21**, 431–435.—The modifications consist essentially in substituting acetic acid for a mineral acid when neutralizing the solution of the alkaline fusion, and using phenolphthalein as indicator instead of litmus. The details of the improved method are given in full, and to these are added many analytical data.

The Influence of Hydrochloric Acid in Titration by Sodium Thiosulphate, with Special Reference to the Estimation of Selenious Acid. By John T. Norton, Jr. *Am. J. Sci.*, 157, 287–293.—In the iodometric method for the determination of selenious acid of Norris and Fay (*this Rev.*, **4**, 31) it was found that the presence of hydrochloric acid did not influence the results providing the reaction took place at the temperature of melting ice. By titrating decinormal solutions of sodium thiosulphate and iodine in the presence of hydrochloric acid under varying conditions of temperature, concentration of acid, and excess of thiosulphate present, the author finds that without certain precautions the presence of hydrochloric acid influences the results very considerably. If the excess of thiosulphate be not more than 20 cc., however, and the concentration of acid be not greater than 10 cc. of hydrochloric acid (sp. gr. 1.12) in 400 cc. of solution, the above process is shown to be very accurate.

The Titration of Oxalic Acid by Potassium Permanganate in the Presence of Hydrochloric Acid. By F. A. Gooch and C. A. Peters. *Am. J. Sci.*, 157, 461–467.—Although it has been stated by several investigators that hydrochloric acid does not interfere with the titration of oxalic acid by potassium permanganate, the authors give experimental data which go to show that the error introduced by the presence of hydrochloric acid is very appreciable. As is the case with the oxidation of ferrous chloride, however, the presence of a suitable amount of a manganous salt entirely prevents the action of the permanganate on the acid.

On the Determination of Sulphur in Sulphites. By A. Bourgougnon. *J. Am. Chem. Soc.*, **21**, 469–470.—The sulphite in dilute hydrochloric acid solution is treated with a solution of hydrogen peroxide, and the sulphuric acid formed is precipitated and weighed as barium sulphate.

PROXIMATE ANALYSIS.

W. H. WALKER, REVIEWER.

Estimation of the Lime, Potash, and Phosphoric Acid in Hawaiian Soils Probably Available for the Immediate Crop. BY WALTER MAXWELL. *J. Am. Chem. Soc.*, 21, 415–417.—In order that the lime, potash, phosphoric acid, and other bases may be dissolved from the soil in the proportion that they are removed by "cropping," the sample is treated with a one per cent. solution of aspartic acid for twenty-four hours. This solution is then evaporated, and the residue is ignited and analyzed by the usual methods.

Notes on the Analysis of Dynamite and Gelatine-Dynamite. BY F. W. SMITH. *J. Am. Chem. Soc.*, 21, 425–431.—Procedures for the analysis of explosives containing nitroglycerine are given in detail, together with the results of several analyses which may be considered typical of this class of products.

ASSAYING.

H. O. HOFMAN, REVIEWER.

The Assay of Telluride Ores. BY C. H. FULTON. *School Mines Quart.*, 19, 419–426.—This paper gives the results of crucible and scorification assays made on two Cripple Creek gold ores assaying about 5 and 450 oz. gold per ton. They show that the crucible assay is to be preferred by far to the scorification method; that in the crucible assay an excess of litharge has a beneficial effect; that the lead-buttons weighing 20–28 grams must be malleable so as to permit direct cupelling and not necessitate any scorification, which is connected with large losses; that the slags carry off considerable gold and have to be reassayed; and that the absorption by the cupel need not be taken into account.

GEOLOGICAL AND MINERALOGICAL CHEMISTRY.

W. O. CROSBY, REVIEWER.

The Petrographical Province of Essex County, Mass. BY HENRY S. WASHINGTON. *J. Geol.*, 6, 787–808; 7, 53–64, 105–121, 284–294.—Although Essex county is a region of great petrographic diversity and interest, and its rocks have received much attention from geologists in the past, and are the subject of a considerable literature, this series of papers is the first systematic and comprehensive petrological study of this now classic area. The author confines his attention to the igneous rocks, which include chiefly granites, quartz-syenites, syenites, nepheline-syenites, essexites, diorites, and gabbros, cut by numerous dikes and with later flows of rhyolite. The entire series is regarded as pre-Carboniferous and post-Cambrian, having cut and metamorphosed the Cambrian strata of the region. The descriptions are supplemented by chemical analyses and a general discussion of the results, including a comparison of this region with others of similar character. The *granites* are all hornblendic, but contain also more or less glaucophane and biotite, and the accessories include danalite, fayalite, allanite, epidote, zircon, magnetite, apatite, fluorite. The feldspar is all of the most acid alkali varieties, including orthoclase, microcline, and albite, occurring largely as highly typical microperthites and cryptoperthites. The analysis shows a typical acid granite, rich in potash and low in lime and iron oxides. The mineralogical composition, as for most of the rocks studied, is calculated from the analysis. Included masses of darker color and finer grain are found to consist of the same essential minerals as the granite, but in different proportions, analysis showing 10 per cent. less silica and much more iron oxide, corresponding to a *quartz-syenite*. *Akerite*, or *augitic quartz-syenite* is found to be almost as abundant as the granites, and the analysis shows it to be closely similar in composition to the dark inclusions of the granite, and like these it is regarded as a differentiation of the granite magma. Another very slight differentiation is afforded by the *nordmarkite* or *mica-hornblende-quartz-syenite*, and the more acid character of this type finds mineralogical expression in the substitution of biotite and hornblende for augite. More strongly contrasted with these, and with an unquestionable claim to separate recognition is the *nepheline syenite*, which has, in comparison, a rather limited development. Two main structure types are recognized, a granitic and a trachytic, which shade into each other and correspond to the *ditroite* and *foyaite* of Brögger, the latter predominating. An analysis is given for each type, the only notable difference being that the foyaite is rather richer in soda and poorer in iron oxide than the ditroite, while both are notably poorer in lime and magnesia than the nepheline syenites of other regions, and higher in silica than the average, agreeing closely with the albite-rich litchfieldite of Bayley. Next comes, as a facies of the nepheline syenite, and showing the same structural distinction, the nepheline-poor to nepheline-free rock known as *pulaskitic syenite* or *pulaskite*. An analysis of each phase of this rock shows that it is decidedly more acid than the normal type of nepheline syenite. This series closes with the *orbicular syenite*, which occurs as rounded inclusions in granite and owes its name to the fact that each prominent phenocryst of hornblende is surrounded by a narrow zone of white feldspar. *Essexite*, described as essentially a basic monzonitic rock containing both lime-soda and alkali feldspars and feldspathoids, is confined to the immediate vicinity of Salem Neck. It is quite distinct from the nepheline syenites, by which it is cut, but grades into the diorites. Sears regards it as the earliest crystallized and most basic portion of the nepheline-syenite magma. Several structural and mineralogical varieties are recognized, and an analysis of a specimen selected by Sears as representing the type shows a decidedly basic rock (SiO_2, 46.99) rich in lime and soda. *Diorite* has a large development in Essex County. It is highly varied and represents transitions from the essexites to the akerites. The analysis shows a rather basic rock for a diorite (SiO_2, 51.82), but, on the other hand, both the silica and alkalies are too high for a gabbro. Besides the main type of diorite, which is often more or less quartzose, the author describes a *quartz-augite-diorite* and a *porphyritic diorite*, with an analysis of the latter. The *gabbro* of Nahant is next described, and the analysis shows that it is low in silica (43.73) and rich in lime (10.99) as a gabbro should be, but also rather poor in magnesia, high in titanium oxide and alumina, and rather high in alkalies, for a gabbro. The hyperitic essexite of Rosenbusch, called also hyperitic diorite in one of the earlier papers of this series, is shown by a later analysis to be more properly a *hornblende-gabbro* (SiO_2, 45.32). The dike rocks next receive attention, beginning with the granitic dikes. These include *aplite*, the very narrow dikes of which are wholly confined to the granite, with which they are found to agree closely in composition, and *quartz-syenite-porphyry*, which is found to be essentially identical in composition with the nordmarkite. The rocks of the *paisanite-sölosbergite-tingnaite* series all form dikes, although of *paisanite* but a single dike has been observed, the analysis of which is almost identical with the aplite. The *sölosbergite* forms numerous dikes, which are described in detail, with two original analyses and one quoted from Rosenbusch. Three *tingnaite* dikes are described, with two analyses, the more basic analysis representing an *analcite tingnaite*. The basic dikes include dikes of *camptonite* (one analysis), *vogesite*, very numerous dikes of *diabase* (one analysis), and dikes of *labradorite porphyry* or *porphyritic diabase*. The work closes with a brief account of the extensive rocks, including the *rhyolite* and *keratophyre* of Marblehead Neck, and with an analysis of each.

M. L. FULLER, REVIEWER.

Augite-Syenite Gneiss near Loon Lake, New York. BY H. P. CUSHING. *Bull. Geol. Soc. Am.*, 10, 177–192.—This is a greenish-gray, massive, igneous rock of cataclastic structure and medium grain, which resembles some phases of the Anorthosites of the region, and was formerly classed with them. It cuts and encloses gneissic rocks which are regarded as unquestionably sedimentary and referred to the Greenville series, and is, in turn, cut by the diabases, the youngest of the pre-Potsdam rocks. The syenite is essentially composed of microperthite, augite, and hypersthene, with quartz always present in varying and commonly slight amount. Other component minerals include zircon, apatite, magnetite, garnet, hornblende, oligoclase, and sometimes biotite, titanite, allanite, and pyrite. The analysis, by E. W. Morley, gives: SiO_2, 63.45; TiO_2, 0.07; Al_2O_3, 18.31; Fe_2O_3, 0.42; FeO, 3.56; MnO, none; CaO, 2.93; BaO, 0.13; MgO, 0.35; K_2O, 5.15; Na_2O, 5.06; P_2O_5, trace; loss, 0.30; total, 99.73. Assuming the augite to be a calcium, ferrous-iron, aluminum silicate, the author calculates from the analysis the proportions of the chief component minerals as follows: Magnetite, 0.73; orthoclase, 30.39; albite, 42.70; anorthite, 4.51; hypersthene, 2.03; augite, 12.02; quartz, 7.07. This result agrees well with that obtained by separation with heavy solutions. The plagioclase is a nearly pure albite, $Ab_{10}Au_{2}$, and the microperthite is approximately $Or_{2}Ab_{6}$. Six other analyses are quoted for comparison, and the Loon Lake rock is seen to agree very closely with several other syenites, and especially with those of Diana, N. Y., Mt. Ascutney, and Gloucester, Mass., which are all referred to an acid phase of the variety called akerite by Brögger. Other Adirondack localities are briefly described, and the rock is shown to vary within quite wide limits, varying from a granite to a syenite more basic than the one analyzed. The relations of the syenites to the anorthosites are also discussed, the conclusion being that the syenites are probably a result of differentiation in the anorthosite magma after reaching its place of final cooling, and in part are somewhat later in date.

Origin of Grahamite. By I. C. White. *Bull. Geol. Soc. Am.*, **10**, 277–284.—The grahamite of Ritchie County, West Virginia, first described by Lesley in 1863, and more fully by Fontaine in 1873, fills a vertical fissure about two-thirds of a mile long, varying in width from a few inches at the ends to 4 and 5 feet in the middle. The fissure is at right angles to and undoubtedly genetically connected with the Burning Springs-Eureka anticlinal which, with dips of from 30° to 70°, crosses the formation about 7 miles west of the deposit. Lesley predicted that "this gash was once an open fissure communicating with some reservoir of coal oil (petroleum) which still, it may be, lies beneath it undisturbed." Oil wells drilled during the past decade have fully verified this prediction, developing at a depth of 1500 to 1600 feet and in close proximity to the grahamite fissure, a pool of oil which is but part of the prolific Cairo oil field. Hence the author concludes that there can be no doubt whatever that the fissure made by tension from the Burning Springs-Eureka uplift was filled with petroleum from this pool, and that subsequently the oil was gradually converted by oxidation from infiltrating water into grahamite without any heat other than that afforded by the normal temperature of the earth. In this connection he cites Jeaney's experimental production of grahamite by passing heated air through petroleum for several hours. As a corollary from this conclusion, albertite, gilsonite, uintaite, and practically all forms of asphalt, including, as suggested by Diller, the "pitch" coal of Coos Bay, Oregon, are oxidized petroleum, and the wonderful deposit of asphalt on the island of Trinidad is regarded as an old oil pool uncovered by erosion and hardened by volatilization and oxidation.

A Contribution to the Study of Contact Metamorphism. BY J. MORGAN CLEMENTS. *Am. J. Sci.*, 157, 81–91.—This paper is essentially a detailed account of a somewhat normal instance of contact metamorphism not hitherto described. It occurs in the Lower Huronian iron-bearing formation of the Crystal Falls district of the upper peninsula of Michigan, where the Mansfield slate formation of the Michiganie Valley is cut by large and continuous masses of coarse dolenite (diabase). The intrusions show no evidence of endomorphic action and are not described; but the slate, which is an undoubted sedimentary deposit, exhibits, as we approach the igneous contact, increasing metamorphism, and the successive phases known as phyllites, tpilosites, desmosites, and adinoles are observed in normal order. The least altered rocks, the normal clay slates, are found on microscopic examination to be of a semicrystalline character, containing, besides elastic quartz and original interstitial matter, secondary white mica, rutile, hematite, and actinolite. The phyllites are similar, except that they are more lustrous, and the interstitial material has been changed to white mica. The spilosites, desmosites. and adinoles are the true contact products. They are dense, flinty, "hornestone-like" rocks, which show in some cases the fine banding of the original slates, while others are very characteristically spotted. The mineralogical components are quartz, feldspar (albite), biotite, chlorite, white mica, actinolite, rutile, epidote, and iron oxide. In the first two varieties chlorite is the chief dark constituent with little or no actinolite, while the opposite relation holds for the adinoles. Complete analyses by George Steiger and H. N. Stokes are given for the normal clay slates, spilosites, and adinoles. A comparison of the analyses shows a marked increase of silica as the dolerite is approached, and a corresponding diminution of alumina and iron as well as of water and carbonaceous matter. The most noteworthy contrast between the clay slate and the contact rocks is shown in the relations of potash and soda. For the clay slate the percentages are 5.73 and 0.54, respectively, while in the contact rocks these proportions are reversed, the successive values for potash being 0.70, 0.22, 0.15, and for soda 6.72, 8.22, 6.57. This agrees with the fact that, while albite is wanting in the clay slate, it is an abundant constituent of the contact rocks. The author concludes that the changes in ultimate chemical composition are probably best explained as due to an actual transfer of material, possibly in the form of a soda silicate, from the basic igneous rock to the intruded slate.

A Contribution to the Geology of the Pre-Cambrian Igneous Rocks of the Fox River Valley, Wisconsin. BY SAMUEL WEIDMAN. *Wis. Geol. and Nat. Hist. Survey, Bull. No.* 3, *Science Series No.* 2, 1–63.—The areas of igneous rocks described in this paper are a part of the cordon of hills and ridges of pre-Cambrian rocks that lie outside the more continuous crystalline cove of central and northern Wisconsin. These outlying hills were islands in the early Paleozoic seas, and around them are deposited the later horizontal formations of sandstone and limestone. Among the pre-Cambrian outliers are to be found rocks of both sedimentary and igneous origin; but those of the Fox River district are wholly igneous, of both plutonic and volcanic nature. Three types are described in great detail, *viz.*, the Utley metarhyolite, Berlin rhyolite-gneiss, and Wanshara granite. They are regarded as of Keweenawan age, and the close agreement of the bulk analyses shows that they are essentially consanguineous and belong with the Baraboo rhyolite to a petrographic province of considerable extent. The acid character of these rocks limits the mineral composition chiefly to quartz and feldspar. An analysis of the feldspar phenocrysts of the Utley metarhyolite shows that they are a soda-lime feldspar with a considerable amount of potash; and in harmony with this composition, the microscope reveals in most cases a micropesthitic structure. This is discussed at some length and shown to be partly original and partly secondary; and the latter is believed to be due in part to an enlargement or outgrowth of the original plagioclase phenocrysts, and in part to intergrowths or regeneration of older plagioclase, the latter process being regarded as allied to paramorphism and not unlike the process of schillerization as described by Judd.

On Hardystonite, a New Calcium Zinc Silicate from Franklin Furnace, New Jersey. BY JOHN E. WOLFF. *Proc. Am. Acad.*, **34**, 479-481.—This is a granular, white, vitreous mineral which is intimately associated with the willemite, rhodonite, and franklinite of the zinc mines. The crystallization is tetragonal with a good basal cleavage and secondary cleavages parallel to the prisms of the first and second orders. The specific grâvity is 3.95, and hardness between 3 and 4. The analyses, recalculated to 100 and omitting iron and ignition as non-essential, give as the normal composition: SiO_2, 38.34; ZnO, 24.45; MnO, 1.50; CaO, 34.07; MgO, 1.62. The molecular ratios give (ZnMn)O : (CaMg)O : SiO_2 as 1 : 2 : 2, with Mn to Zn and Mg to Ca as 1 to 15; and the formula is hence $(ZnMn)O,2(CaMg)O,2SiO_2$ or $ZnO,2CaO,2SiO_2$, the theoretical composition of the latter being: SiO_2, 38.34; ZnO, 25.88; CaO, 35.78.

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REVIEW OF AMERICAN CHEMICAL RESEARCH.

VOL. V. NO. 10.

ARTHUR A. NOYES, Editor.
REVIEWERS: Analytical Chemistry, H. P. Talbot and W. H. Walker; Biological Chemistry, A. G. Woodman; Carbohydrates, G. W. Rolfe; General Chemistry, A. A. Noyes; Geological and Mineralogical Chemistry, W. O. Crosby and M. L. Fuller; Inorganic Chemistry, Henry Fay; Metallurgical Chemistry and Assaying, H. O. Hofman; Organic Chemistry, J. F. Norris; Physical Chemistry, H. M. Goodwin; Sanitary Chemistry, E. H. Richards; Technical Chemistry, A. H. Gill and F. H. Thorp.

GENERAL AND PHYSICAL CHEMISTRY.

A. A. NOYES, REVIEWER.

The Theory of the Formation of Nickel Sulphide. BY J. LIVINGSTON R. MORGAN, AND A. H. GOTTHELF. *J. Am. Chem. Soc.*, 21, 494–502.—The authors attempt to show that the well-known fact that nickel and cobalt sulphides when once formed are not dissolved by acids of a concentration much greater than is required for preventing entirely their precipitation by hydrogen sulphide, can be explained simply by an application of the principles of mass-action and of electrolytic dissociation, assuming an appropriate value for the solubility of the sulphides. The considerations of the authors are, in the reviewer's opinion, erroneous in some essential points (thus this is true of the statements that no undissociated nickel sulphide or hydrogen sulphide will be formed till the product of the concentrations of their respective ions reaches the value of the "solubility-product"), but it is unnecessary to discuss these in detail, since it is *a priori* evident that the principles of equilibrium as ordinarily applied cannot possibly explain the phenomenon in question; for, if equilibrium exist between the four substances, $NiCl_2$, H_2S, HCl, and NiS (solid), when the first two are present in large amount and the last two in very small amount, it is clear that the conditions must be *far* removed from those of equilibrium when the last two compounds are alone brought together, and conversely. The probable explanation, previously suggested by Ostwald (*Scientific Foundations of Analytical Chemistry*, p. 149), of this apparent anomaly, is that after precipitation the nickel sulphide rapidly undergoes a change in its chemical nature (perhaps a dehydration), the new form being much less soluble in water and therefore in acids than the original one. By quantitative experiments Ostwald has proved that this is the case with zinc sulphide, and the same property, in a much more pronounced degree, seems to be possessed by nickel and cobalt sulphides.

The Effect of Diionic Electrolytes on the Solubility of Triionic Electrolytes with Different Ions. BY ARTHUR A. NOYES AND EDWARD S. CHAPIN. *J. Am. Chem. Soc.*, 21, 511–516.—The authors derive the theory of the phenomenon mentioned in the title and communicate experiments confirming it on the solubility of calcium hydroxide in water and ammonium chloride solutions.

The Theory of the Separation of Barium, Strontium, and Calcium from the Mixed Sulphates. BY J. LIVINGSTON R. MORGAN. *J. Am. Chem. Soc.*, 21, 522–526.—It is shown that the separation of the sulphates named, by ammonium carbonate or a mixture of potassium sulphate and carbonate, is readily explained by the dissociation theory and the laws of solubility-effect.

The Atomic Mass of Tungsten and the Preparation of Sodium Pertungstate by Means of the Electric Current. BY GEORGE EDWARD THOMAS. *J. Am. Chem. Soc.*, 21, 373–381.—In the first part of the article it is shown that two samples of tungsten trioxide, prepared from distinct minerals, scheelite and wolframite, are apparently identical, but that both of them fail to give concordant values of the atomic weight when reduced to the metal or when the latter is reoxidized; also that the method of determining the atomic weight from the loss of weight occurring when crystallized sodium tungstate is heated sufficiently to expel the water is an unsuitable one. In the second part the author describes the results of electrolyzing sodium tungstate, considering that a pertungstate is formed thereby, since a substance liberating chlorine, iodine, and ozone was obtained, though not in a state of even approximate purity.

The Surface-Tensions of Aqueous Solutions of Alkaline Chlorides. BY C. E. LINEBARGER. *J. Am. Chem. Soc.*, 21, 411–415.—Equimolecular solutions of potassium, sodium, and lithium chlorides are found to have the same surface-tension; and their surface-tension is found to be only approximately a linear function of the concentration.

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REVIEW OF AMERICAN CHEMICAL RESEARCH.

VOL. V. NO. 11.

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ANALYTICAL CHEMISTRY.

ULTIMATE ANALYSIS.

H. P. TALBOT, REVIEWER.

Carbon Combustions in a Platinum Crucible. BY P. W. SHIMER. *J. Am. Chem. Soc.*, **21**, 557–568.—By means of an ingeniously-devised water-cooled stopper, an ordinary platinum crucible is made to take the place of the usual combustion tube, the combustion taking place in a current of air, and the heat being applied by means of a blast-lamp. The gases, on leaving the crucible, pass over a layer of heated cupric oxide, then over beads moistened with cold water, and finally through the usual absorption apparatus. The results obtained are highly satisfactory, and the time required for the completion of the combustion is small. The original article furnishes details of construction and use which are of unusual interest, and suggest that the apparatus may find other uses beside that in the determination of carbon.

The Determination of Carbon and Hydrogen in Organic Substances Containing Nitrogen. BY O. F. TOWER. *J. Am. Chem. Soc.*, **21**, 596–605.—The author finds that during the combustion of amido compounds, such as urea, hippuric acid, and paratoluidine, no oxides of nitrogen are formed which are absorbed by concentrated sulphuric acid or soda-lime, even in the absence of a copper spiral. The same statement applies to the combustion of nitraniline and dinitrobenzene, but picric acid required the introduction of a copper spiral for the accurate determination of the carbon and hydrogen.

A Volumetric Method for Magnesium. By Richard K. Meade. *J. Am. Chem. Soc.*, **21**, 746–752.—The magnesium is precipitated as magnesium ammonium arsenate, this precipitate dissolved in dilute hydrochloric acid, after which potassium iodide is added to the solution, and the liberated iodine is titrated with sodium thiosulphate solution. The results obtained are quite satisfactory.

The Estimation of Arsenic in Paris Green. By Thorn Smith. *J. Am. Chem. Soc.*, **21**, 769–772.—The Paris green is treated with a solution of sodium hydroxide which, in the presence of the arsenite, causes a precipitation of cuprous oxide. This is removed by filtration, and, after acidifying with hydrochloric acid, potassium iodide is added, the liberated iodine is reduced by the cautious addition of sodium thiosulphate, and the arsenite is determined by titration with iodine. (Compare also the "*Volumetric Method for Magnesium*" *above*).

A New Method for the Direct Determination of Alumina in the Presence of Iron, Manganese, Calcium, and Magnesium. By William H. Hess and E. D. Campbell. *J. Am. Chem. Soc.*, **21**, 776–780.—The solution of the chlorides of the metals is made nearly neutral with ammonia, ammonium bisulphite is added to reduce the iron, and then one or two cc. of phenylhydrazine. This precipitates the alumina and the phosphoric acid. The precipitate is washed with a solution of phenylhydrazine bisulphite, and then ignited. Chromium may be separated from iron in the same way.

The Determination of Antimony in Ores. By Thomas Brown, Jr. *J. Am. Chem. Soc.*, **21**, 780–789.—The author gives a detailed account of methods of analysis applicable, in particular, to Mexican ores.

Electrolytic Determination of Zinc in the Presence of Manganese. By Emil J. Riederer. *J. Am. Chem. Soc.*, **21**, 789–792.—The zinc is deposited on a silver-coated platinum dish, from solutions containing lactic acid, ammonium lactate, and ammonium sulphate, and the solution is stirred during the deposition, which requires from four to five and one-half hours for completion. The deposited zinc is free from manganese.

The Determination of Sulphur in Bitumens. By S. F. and H. E. Peckham. *J. Am. Chem. Soc.*, **21**, 772–776.—The authors criticise statements made by E. H. Hodgson (see *this Rev.*, 5, 10) with respect to the accuracy of his method, and give in detail an account of the deflagration method as practiced by them.

W. H. WALKER, REVIEWER.

The Estimation of Iron in the Ferric State by Reduction with Sodium Thiosulphate and Titration with Iodine. BY JOHN T. NORTON, JR. *Am. J. Sci.*, **158**, 25–30.—Although a great deal of work has been done in the endeavor to estimate iron by reduction with sodium thiosulphate, no satisfactory method has as yet been proposed. The concentration of the ferric solution, the amount of acid present, the excess of thiosulphate used, and the length of time allowed for reduction, all greatly influence the reaction. After a great deal of experimenting the following conditions were found to give the most satisfactory results. The concentration of the iron solution must not be greater than 0.1 gram ferric oxide in 400 cc.; the amount of acid present should not exceed 1 cc. of the strong acid in the same volume; the time of reduction must be as short as possible to prevent progressive oxidation by air; and the excess of thiosulphate used should, for the same weight of iron, be not less than 15 cc. of a decinormal solution.

The Determination of Tellurous Acid in Presence of Haloid Salts. BY F. A. GOOCH AND C. A. PETERS. *Am. J. Sci.*, **158**, 122–126.—In a previous paper (*this Rev.*, **5**, 89) it was shown that the reaction between potassium permanganate and oxalic acid in acid solution is not influenced by the presence of chlorides, provided a quantity of manganous salt be added before titration. This modification is introduced into the method for determining tellurous acid by means of permanganate and oxalic acid. By causing the first oxidation to take place in alkaline solution, and making the final titration of the residual oxalic acid in acid solution in the presence of a manganous salt, the estimation of tellurous acid in the presence of chlorides and bromides was found quite satisfactory. In the case of an iodide, however, the presence of a manganous salt is not sufficient to prevent the action of the permanganate, and iodine is set free. As was shown by Norris and Fay (*this Rev.*, **4**, 31), this free iodine may replace the oxalic acid as a measure of the excess of the permanganate used in oxidizing the tellurous acid, and its amount was determined by the authors by reducing it with standard arsenite solution in the presence of an excess of sodium bicarbonate.

An Iodometric Method for the Estimation of Boric Acid. BY LOUIS CLEVELAND JONES. *Am. J. Sci.*, **158**, 127–132.—In a volumetric method for the estimation of boric acid (*this Rev.*, **5**, 52) it was found that the addition of mannite to the free boric acid made it possible to determine the acid by titration with standard alkali solution. If the solution is almost saturated with mannite (glycerine does not serve the same purpose), the boric acid is rendered active enough to react with potassium iodide and potassium iodate setting free an amount of iodine equivalent to the metaboric acid present:

$$5KI + KIO_3 + 6HOBO = 3I_2 + 6KOBO + 3H_2O.$$

The iodine may be reduced with standard thiosulphate solution, and the amount of boric acid calculated. The necessary precautions as to concentration and temperature are given, and the results obtained seem very satisfactory.

The Double Ammonium Phosphates of Beryllium, Zinc, and Cadmium in Analysis. BY MARTHA AUSTIN. *Am. J. Sci.*, **158**, 206–216.—The influence which varying conditions of temperature and concentration, excess of precipitant, and amounts of ammonium chloride have on the composition of the resulting insoluble phosphates thrown out of solution by means of sodium acid phosphate or microcosmic salt, has been studied with a view of determining the utility of the compounds in quantitative analysis. It was found impossible to precipitate beryllium as the true beryllium ammonium phosphate; and no determinations made by weighing the pyrophosphate were sufficiently accurate to be of much value. In the presence of ammonium chloride (10 grams in 100 cc.), zinc ammonium phosphate may be obtained in the ideal condition, and forms the basis of a very accurate method for the determination of zinc. In the case of cadmium the precipitate with microcosmic salt in the presence of the same amount of ammonium chloride is also the true double ammonium phosphate, if it be allowed to stand for several hours before filtering. But there must, in this case, be no excess of ammonia, no free acid, and neither more nor less than the amount of ammonium chloride stated.

Separation of Iron from Chromium, Zirconium, and Beryllium, by the Action of Gaseous Hydrochloric Acid on the Oxides. BY FRANKE STUART HAVENS AND ARTHUR FITCH WAY. *Am. J. Sci.*, **158**, 217–218.—The procedure for the separation of iron from chromium, beryllium, and zirconium is the same in the case of each metal, and analogous to that employed by the author (*this Rev.*, 5, 87) for the separation of iron from aluminum. The results given are very satisfactory.

Methods for the Iron Laboratory. BY FRANK L. CROBACH. *Iron Trade Rev.*, **32**, Nos. 24 to 29.—This paper consists of a series of five articles in which "the writer outlines for the benefit of beginners in foundry, steel works, and blast-furnace laboratories the methods he considers preferable."

PROXIMATE ANALYSIS.

A. G. WOODMAN, REVIEWER.

The Assay of Opium: A Supplementary Note. BY H. M. GORDIN AND A. B. PRESCOTT. *Pharm. Rev.*, 17, 244–249.—The authors report an improvement in their process for the assay of opium (*Pharm. Arch.*, 1, 121; *this Rev.*, 4, 115), consisting in the use of a more desirable solvent for extracting the morphine and an adaptation to the use of standard acid for the volumetric estimation of the morphine.

The Distinction of True Extract of Vanilla from Liquid Preparations of Vanillin. BY WILLIAM H. HESS. *Pharm. Rev.*, 17, 254–257.—The simplest means of proving the origin of vanilla extract consists in the separation and identification of the characteristic resin of which vanilla beans contain from four to eleven per cent. Simple tests for coloring-matters, chiefly caramel and certain azo dyes, and an examination of the behavior of the extract upon dilution with water are also found useful.

A New Test for Cocaine. BY GEORGE L. SCHAEFER. *Am. J. Pharm.*, 71, 222–223.—In order to determine the freedom of commercial cocaine salts from other coca alkaloids, the author has devised a simple test based on the relative insolubility of the chromates of the coca alkaloids in dilute hydrochloric acid.

Assay of Nux Vomica. BY W. O. RICHTMANN. *Pharm. Rev.*, 17, 208–210.—Attention is called to the necessity of using a greater quantity of decinormal sulphuric acid in testing the evaporated percolate obtained in making fluid extract of nux vomica.

A Contribution to the Chemistry of Butter-fat. BY C. A. BROWNE, JR. *J. Am. Chem. Soc.*, 21, 612–633.—The author has determined in a number of samples of butter-fat the various physical and chemical constants that are usually determined in the examination of the fat together with a number of those not commonly found. Several of the methods and modifications employed are described in considerable detail.

The Assay of Belladonna Leaves. BY FRANK X. MOERK. *Am. J. Pharm.*, 71, 320–326.—The author has shortened the time required for the assay of belladonna leaves by using a mixture of 90 parts, by weight, of 95 per cent. alcohol and 10 parts, by weight, of 10 per cent. aqua ammonia for extraction purposes instead of the menstruum usually employed (2 volumes alcohol and 1 volume water).

On Acetic Acid as a Substitute for Ethyl Alcohol in Extracting the Active Principles of some Officinal Drugs. BY EDWARD R. SQUIBB. *Am. J. Pharm.*, 71, 305–320.—In continuation of his previous work upon this subject, the author has carried out experiments with cinchona, and finds that this drug is readily and completely exhausted, even when in fairly coarse powder, by ten per cent. acetic acid. A detailed procedure for the assay of cinchona is worked out and a description is given of a modified form of siphon extractor which has been found to work successfully.

Newer Observations Concerning the Detection of Blood by Means of the Guaiacum Reaction. BY EDWARD SCHAER. *Am. J. Pharm.*, 71, 361–370.—In a previous paper the author has proposed to improve the guaiacum-blood reaction, as ordinarily used, by substituting for the usual alcoholic guaiacum solution a five per cent. alcoholic solution of guaiacum resin. The intimate mixture of the coloring-matter of blood and guaiacum resin thus obtained may be preserved for an indefinite time and can at any time be used to exhibit the "guaiacum blue" with hydrogen peroxide or Hünefeld's reagent. A further improvement is now suggested consisting in the use of a solution of chloral hydrate to extract the blood stains. The stains, after being moistened with acetic acid, can be extracted either with a 70 per cent. chloral hydrate solution or with a one per cent. solution of guaiacum in aqueous chloral hydrate containing 70–75 per cent. of the latter. To the blood-guaiacum solution in aqueous chloral hydrate thus obtained is added either hydrogen peroxide solution or Hünefeld's liquid so that the two layers do not mix. The blue zone will appear at the place of contact. The guaiacum-blood test with chloral hydrate can also be applied to the identification of the hemin crystals of blood, which is often of great importance. A solution of guaiaconic acid in chloral solution can be substituted for the ordinary guaiacum solution if desired.

On the Determination of Added Water in Milk. BY A. G. WOODMAN. *J. Am. Chem. Soc.*, 21, 503–508.—The most successful of the methods for the direct determination of the added water in milk is that based upon the specific gravity of milk from which the casein has been removed. The conditions necessary to obtain concordant results have been studied and tables are given showing the specific gravity of the serum from milks of varying dilution.

Paraffin as an Adulterant of Oleomargarine. BY JOSEPH F. GEISLER. *J. Am. Chem. Soc.*, 21, 605-608.—The amount of paraffin which has been found in oleomargarine varies from 5 to

11.76 per cent. Its presence is clearly indicated by the low specific gravity of the fat. If the amount present is over three per cent. it will separate out when the alcoholic soap solution obtained by the Reichert method is diluted with an equal volume of water. The appearance of the fat under polarized light is shown by photomicrographs.

An Examination of Commercial Flour. By Henry Kraemer. *J. Am. Chem. Soc.*, **21**, 650–663.—The author proposes a microchemical method for the estimation of corn-meal in flour. A number of small samples, about 0.0039 gram each, are treated under the microscope with various reagents, which serve to distinguish the grains. The number of grains of each kind in a given field is counted, the average of several samples being taken.

A Method of Analysis for Canned Condensed Milk. By F. S. Hyde. *J. Am. Chem. Soc.*, **21**, 439–444.—The author describes in detail the method used by him which consists in general in diluting the sample with a known quantity of water until it has about the consistency of cow's milk, weighing out aliquot parts of this stock solution, and applying the ordinary methods of milk analysis. A table of results is appended.

G. W. Rolfe, Reviewer.

The Influence of Temperature on the Specific Rotation of Sucrose and Method of Correcting Readings of Compensating Polariscopes Therefor. By Harvey W. Wiley. *J. Am. Chem. Soc.*, **21**, 568–596.—This important investigation is on the influence of temperature on sugar polarizations between 4° and 40° C. The constant correction factor is in close agreement with those obtained by Andrews and the U. S. Coast and Geodetic Survey, and only slightly less than that given by Landolt and Schönrock. It would seem from the amount of data now at hand that the table of temperature corrections for polarizations compiled by the author could be adopted generally in commercial and scientific work, and it undoubtedly will be. However, the statements of the data given for the light factor of the Ventzke saccharimeter require fuller explanation lest false conclusions be drawn and the work of former accurate observers be discredited. It should have been stated that there are three figures, representing the light factor of the Ventzke saccharimeter, any one of which is correct, according to the conditions of measurement. The one last given by Landolt, 0.3468–9, represents the equivalent of one division of the new Ventzke saccharimeter whose graduation is based on 26.048 grams of cane-sugar dissolved in 100 "*true*" centimeters when this is measured in angular degrees of rotation of the light of a sodium flame made as monochromatic as possible by filtration through a Landolt-Lippich ray filter; but if ninety-nine out of a hundred of the Ventzke instruments in the laboratories of the country were compared in this manner, the factor obtained would probably be 0.3461–2, since practically all of the saccharimeters in common use are graduated for 26.048 grams of cane-sugar in 100 "*Mohr centimeters*" at 17.5° C., an "urnormal" plate on these Ventzke instruments reading some two-tenths of a division higher than its recorded value. Finally if the angular measurement in the last case is made on a Laurent polariscope as is common, or a Wild, both of which instruments use a sodium flame filtered through bichromate only, the factor becomes 0.3455–7. Clearly for the conditions defined these factors are equally correct. By the work of many independent investigators, the third factor seems to be established beyond question as a reliable constant for the light ray obtained by the Laurent and Wild apparatus, notwithstanding that Landolt and Lippich have pointed out that defective construction is more liable to make the Laurent instrument inaccurate than some others. However, the question which is important to the analyst is not what is the best standard of light measurement to be eventually adopted by all as more closely conformable to the absolute theoretical standards, but what factor applies to the instruments he is using. In the majority of cases this is obviously the last. It is interesting to note that in the various works published in the last few years, all these light factors can be found, some one of them in each instance being given without comment as the correct value.

Xanthene Bases in Sugar Cane. BY EDMUND C. SHOREY. *J. Am. Chem. Soc.*, **21**, 609–612.—The author finds traces of guanine in Hawaiian cane juices, and finds that this body is unchanged in the process of sugar manufacture and hence has a tendency to accumulate in the final molasses. As guanine combines with cuprous oxide, the author thinks that in the case of very low-grade products this might introduce an error if the copper is not redissolved as in the electrolytic process. He also points out that guanine may be estimated as a peptone or amide if precautions are not taken.

Report on Sugar Analysis. BY R. S. HILTNER. *Proc. Assoc. Offic. Agr. Chem., Bull. U. S. Dept. Agr.*, **56**, 87–96.—The author recommends (1) that the Carr and Sanborn method for the determination of water in molasses, etc. be adopted; (2) that the quartz sand method be optional, however; (3) that the density method be restricted to high-grade products; (4) that the directions of the Lucien method for ash be revised; (5) that the Formanek be the only electrolytic method used in determining reducing sugars; (6) that in the directions for the permanganate method for reducing sugars the number of grams of permanganate used be stated; and (7) that the Creydt method for the determination of sucrose and raffinose be adopted provisionally.

INORGANIC CHEMISTRY.

HENRY FAY, REVIEWER.

On the Color of Compounds of Bromine and Iodine. BY J. H. KASTLE. *Am. Chem. J.*, **21**, 398–413.—The color of the compounds of the halogens is discussed, and it is shown that the power of producing color increases from fluorine to iodine. It is shown that the compounds having the least color are most stable, while the colored compounds are usually easily decomposed, giving rise to colors which are similar to the color of the halogen in the free state. On heating a colored compound the intensity of the color is increased and the reverse process takes place on cooling. The author assumes that in colored compounds there is slight dissociation of the solid substance, the color being due to small quantities of the free halogen. The property of color in the halogen compounds is supposed to be an additive and not a constitutive property. Examples of a large number of inorganic and organic halogen compounds are given. Among the aromatic organic compounds it is shown that the color varies with the stability of the compound. Substitution of halogens in the benzene ring produces stable compounds, and they are usually colorless, while the side-chain substitution products are usually colored and are more unstable.

The Action of Ammonia and Amines on Chlorides of Silicon. BY FELIX LENGFELD. *Am. Chem. J.*, **21**, 531–537.—On bringing together benzene solutions of ammonia and silicon tetrachloride, silicon tetramide, $Si(NH_2)_4$, is formed. This substance breaks down, rapidly with water and more slowly in the air, with loss of ammonia into silicon diimide, $Si(NH)_2$. It had generally been believed that the product of the action of ammonia on silicon tetrachloride was the compound $SiCl_4.6NH_3$, but the author considers it a mixture of silicon diimide and ammonium chloride, the composition of the mixture being represented by the formula $Si(NH)_2.4NH_4Cl$. Silicon tetrethylamine is a colorless oil that does not solidify in a freezing-mixture. It keeps indefinitely in closed tubes, is decomposed by water, and boils at 102° under a pressure of 20 mm.

The Action of Chromic Acid on Hydrogen. BY CHAS. L. REESE. *Am. Chem. J.*, **22**, 158–164. Hydrogen is oxidized by a saturated chromic acid solution in presence of a porous material like platinized asbestos, burnt clay balls or balls made of gypsum, but pure chromic acid does not oxidize hydrogen even in the presence of considerable quantities of sulphuric acid. The oxidation of hydrogen takes place at and above 61° when heated for a sufficient length of time; but at 50° the absorption is very slight, even after two hundred and eighty-eight hours, and at 40° there is no oxidation. Saturated solutions of chromic acid evolve oxygen freely at 119° and above, and as hydrogen is oxidized at temperatures below those at which oxygen is given off, the oxidation of hydrogen seems not to be dependent upon the evolution of oxygen from chromic acid by heat. Electrolytic hydrogen produced by passing a current through a chromic acid solution, is not oxidized by pure chromic acid, but is readily oxidized in the presence of other substances. When sulphuric acid or sulphates are added, oxidation takes place up to a certain limit, depending upon the percentage of sulphuric acid, and then ceases entirely.

Dehydration of Crystals of Sodium Phosphate. By T. C. Whitlock and C. E. Barfield. *Am. Chem. J.*, **22**, 214–215. The water of constitution of disodium hydrogen phosphate begins to be lost at 230°; below this temperature water of crystallization may be determined.

Solubility of Lead Sulphate in Ammonium Acetate. By J. C. Long. *Am. Chem. J.*, **22**, 217–218.—Approximate values of the solubility of lead sulphate in ammonium acetate solution are given.

Classifications of the Carbides: Their Modes of Formation and Reactions of Decomposition. By J. A. Mathews. *J. Am. Chem. Soc.*, **21**, 647–650.—The author has classified the carbides according to their arrangement in the periodic system, their decomposability by water, their reaction with the halogens or halogen acids, and their behavior toward heat and oxidizing agents. The different methods of preparation and the products of decomposition which serve as a means of classification, are given.

Preparation of Graphitoidal Silicon. By Frederick S. Hyde. *J. Am. Chem. Soc.*, **21**, 663–665.—The method depends upon the reduction of finely pulverized white sand with magnesium powder and the subsequent fusion of the reduction-product with cryolite and aluminium, thus forming an alloy of aluminium and silicon, from which the latter is obtained on treatment with hydrochloric acid.

Action of Hydrochloric Acid Gas upon Sulphates, Selenates, Tellurates, and Phosphates. BY RAYMOND W. TUNNELL AND EDGAR F. SMITH. *J. Am. Chem. Soc.*, **21**, 929–932.—Hydrochloric acid completely removes selenium and tellurium from the mixture of selenic or telluric acids with phosphoric acid, but will not separate these elements from sulphuric acid, some of the latter always being carried over. It was found that dry hydrochloric acid passed over dry potassium sulphate in the cold, combined with the latter, and the product formed maintained its composition at 130° and did not lose in weight when kept over soda-lime in a vacuum desiccator for fifteen hours. When dry potassium sulphate was heated in dry hydrochloric acid gas from 200° to a dull red heat, sulphuric acid was found in the receiver, while the substance remaining behind after this treatment weighed more than the original substance.

The Precipitation of Copper by Zinc. BY JOHN C. SHENGLE AND EDGAR F. SMITH. *J. Am. Chem. Soc.*, **21**, 932–933.—The precipitation of copper by zinc was found to give fair quantitative results, but some zinc was always found in the copper.

The Persulphates of Rubidium, Cesium, and Thallium. ARNOTT R. FOSTER AND EDGAR F. SMITH. *J. Am. Chem. Soc.*, **21**, 934–936.—These salts were prepared by electrolyzing a mixture of two parts sulphuric acid (sp. gr. 1.35) with one part of a saturated solution of the sulphate. It was impossible to isolate the thallium persulphate on account of its great solubility and the rapidity with which it decomposed in the air.

BIOLOGICAL CHEMISTRY.

A. G. WOODMAN, REVIEWER.

Saw Palmetto. BY P. L. SHERMAN AND C. H. BRIGGS. *Pharm. Archives*, **2**, 101–116.—The oil extracted by pressure from the fruit of the saw palmetto and also that expressed from the nuts were examined in order to ascertain their composition. The oil obtained from the pulp of the fruit was distilled under reduced pressure and found to consist of caproic, caprylic, capric, lauric, palmitic, and oleic acids and their ethyl esters, about 62 per cent. of the oil being free acids and 37 per cent. esters. The oil of the nuts contained only 2.3 per cent. free acids, the greater part of it being the glycerides of the same acids as the pulp oil with the addition of stearic acid and without the caproic acid. No alkaloids were found and the fruit was found to contain 5.4 per cent. of invert sugar.

Improvement in the Chemical Composition of the Corn Kernel. By C. G. Hopkins. *Ill. Agr. Expt. Sta.*, *Bull.* 55, 205–240.—Experiments have been made with the object of improving the composition of the grain. The results which have been thus far obtained indicate that it is possible to bring this about by proper selection of the seed. The proportion of protein, fat, or carbohydrate may be increased or diminished at will. The fat content of the grain seems to be more susceptible to the influence of seed selection than is the protein content.

A Chemical Study of Wheat. By G. B. Frankforter and E. P. Harding. *J. Am. Chem. Soc.*, 21, 758–769.—The authors have studied wheat oil, determining some of the usual analytical constants. By extracting the saponified oil with ether and also by a new method involving the elaidin reaction a form of cholesterol, corresponding closely to paracholesterol, was obtained.

Egg Albumin. By Thomas B. Osborne. *J. Am. Chem. Soc.*, 21, 477–485.—Crystallized egg albumin, prepared by the addition of hydrochloric or acetic acid and ammonium sulphate to egg white, was purified by recrystallization and dialysis and analyzed. The results obtained furnish additional evidence that egg albumin as usually prepared is a mixture of two protein substances found in egg white.

On Some Definite Compounds of Protein Bodies. By Thos. B. Osborne. *J. Am. Chem. Soc.*, 21, 486–493.—By the use of various indicators it is shown that many of the forms of protein as usually hitherto prepared are either chemical compounds of the protein substance with ordinary mineral acids, or at least contain such compounds. This subject has been investigated more especially in the case of edestin, the mono- and bihydrochlorates of which have been prepared and studied.

The Physiological Effect of Creatin and Creatinin and Their Value as Nutrients. By J. W. Mallet. *U. S. Dept. Agr.*, *Bull.* 66, 1–24.—A study of the chemical and physical properties of creatin and creatinin made on considerable quantities of the pure substances showed some disagreement with the description given in text-books. Determinations of the molecular heat of combustion made by Atwater gave 559 calories for creatin and 517.9 calories for creatinin. Before carrying out the physiological experiments a method was worked out and used for the quantitative separation of creatin, creatinin, and urea, which gave fairly good results. In the physiological experiments the rates of the pulse and the respiration, the body temperature, and the reaction of the urine were observed at definite intervals. The amounts of creatin, creatinin, and urea in the excreted urine were determined. The principal conclusion derived from the results obtained is that the flesh bases do not undergo metabolism in the body, but are for the most part eliminated by way of the kidneys. Creatinin is excreted unchanged, while creatin is very largely converted to creatinin. Creatin and creatinin, then, although occurring in food, are to be disregarded as sources of energy, being eliminated from the body practically unchanged.

The Toxic Action of Sodium Fluoride. BY HERBERT B. BALDWIN. *J. Am. Chem. Soc.*, **21**, 517–521.—The author mentions several recent cases of ill effects resulting from the use of sodium fluoride and cites the work of a number of investigators, which goes to show that sodium fluoride belongs to the class of the less violent poisons.

Food Products. BY A. L. WINTON AND OTHERS. *Conn. Agr. Expt. Sta., Ann. Rep.* **22,** *Part II*, 106–223.—This is a report of the results obtained in the analysis of various food products offered for sale throughout the state, with a description of the analytical methods employed.

The Chemical Composition of American Food Materials. BY W. O. ATWATER AND A. P. BRYANT. *U. S. Dept. Agr., Bull.* **28** (Rev. Ed.), 1–87.—This bulletin contains the maximum, minimum, and average analyses of all available American food products up to Jan. 1, 1899, with the exception of milk, butter, and other dairy products, and of sugars. The literature of the subject has been thoroughly gone over, and the tables of analyses will be found quite complete.

Some Nevada Soils. BY N. E. WILSON. *Nev. Agr. Expt. Sta., Bull.* **39,** 1–30.—This bulletin contains the results of analyses of twenty-six samples of representative Nevada soils.

Notes on Alkali Soil in Montana. BY F. W. TRAPHAGEN AND W. M. COBLEIGH. *J. Am. Chem. Soc.*, **21**, 753–757.—The alkali found in the Montana soils consists almost entirely of sulphates, mainly sodium sulphate. This alkali is ordinarily concentrated in a zone at a considerable depth, but when irrigation is employed the salts begin to rise to the surface and cause damage to the crops. When, however, the soil is underlain with gravel the alkali does not rise, showing that the best remedy consists in underdrainage.

Commercial Fertilizers. *Vt. Agr. Expt. Sta., Bull.* **69,** 41–53; **70,** 55–68; **71,** 71–116; *Tex. Agr. Expt. Sta., Bull.* **51,** 24–37; *R. I. Agr. Expt. Sta., Bull.* **56,** 1-9; *Ky. Agr. Expt. Sta., Bull.* **82,** 15-32.

G. W. ROLFE, REVIEWER.

The Sugar Beet in Maryland. BY H. W. WILEY. *Md. Agr. Expt. Sta., Bull.* 61, 169–186.—The author reviews the history of the experimental work done in the state, and concludes that "in the present state of the sugar industry it has been established that Maryland cannot successfully compete in the manufacture of beet-sugar with more favorable localities in the United States."

Sugar as Food. BY MARY HINMAN ABEL. *Farmers' Bull. U. S. Dept. Agr.*, 93, 7–26.—This bulletin treats in a popular way of the composition, sources, food value, and practical use of cane-sugar.

Variations in the Analyses of Cane Ashes. BY ROBT. HALL. *La. Planter*, 23, 179–180.—The extraordinary variations in the amount of fertilizing constituents, especially potash, shown by published analyses, are pointed out.

The Field of Chemical Improvement in the Manufacture of Cane Sugar. BY WILFRED SKAIFE. *La. Planter*, 23, 107–109.—The author reviews some of the great problems of sugar manufacture from field to finished product.

[CONTRIBUTION FROM THE MASSACHUSETTS INSTITUTE OF TECHNOLOGY.]

REVIEW OF AMERICAN CHEMICAL RESEARCH.

VOL. V. NO. 12.

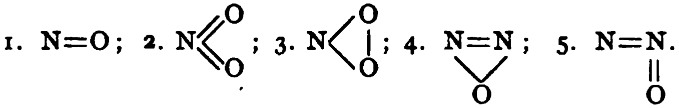
ARTHUR A. NOYES, Editor.
REVIEWERS: Analytical Chemistry, H. P. Talbot and W. H. Walker; Biological Chemistry, A. G. Woodman; Carbohydrates, G. W. Rolfe; General Chemistry, A. A. Noyes; Geological and Mineralogical Chemistry, W. O. Crosby and M. L. Fuller; Inorganic Chemistry, Henry Fay; Metallurgical Chemistry and Assaying, H. O. Hofman; Organic Chemistry, J. F. Norris; Physical Chemistry, H. M. Goodwin; Sanitary Chemistry, E. H. Richards; Technical Chemistry, A. H. Gill and F. H. Thorp.

ORGANIC CHEMISTRY.

J. F. NORRIS, REVIEWER.

Trinitrophenylmalonic Ester. BY C. LORING JACKSON AND J. I. PHINNEY. *Am. Chem. J.*, **21**, 418–433.—Trinitrophenylmalonic ester, as prepared by Jackson and Soch (*this Rev.*, **2**, 10), crystallizes from alcohol in slender, rectangular needles, which melt at 58°. When precipitated from its ammonium salt and recrystallized the ester is obtained in kite-shaped crystals, which melt at 64°. The low-melting crystals are readily changed into the high-melting variety by melting, and by inoculating a saturated solution of them with a crystal of the form melting at 64°. After the high-melting crystals were once obtained it was found difficult to prepare the unstable form, as the dust of the former in the laboratory influenced the crystallization of the compound. It was found impossible to convert the stable into the unstable form. The two compounds were not polymeric modifications, as the new body was shown to have a simple molecular weight. Alkalies give with the ester melting at 64° dark-red salts, which crystallize well. The barium, strontium, calcium, zinc, cadmium, copper, and lead salts are highly-colored precipitates. When the ester was treated with concentrated nitric acid on the steam-bath, a nitrite was formed of the formula $C_6H_2(NO_2)_3CONO(CO_2C_2H_5)_2$ (m. p. 109°). By long-continued action of nitric acid, trinitrophenyltartronic ester (m. p. 167°) results, which is converted into an acetyl derivative (m. p. 125°) when heated in a sealed tube with acetyl chloride. Trinitrophenylacetic acid (m. p. 161°) was formed when the trinitrophenylmalonic ester (m. p. 64°) was saponified with sulphuric acid.

The Relation of Trivalent to Pentavalent Nitrogen. BY ARTHUR LACHMAN. *Am. Chem. J.*, **21**, 433–446.—In order to get some experimental evidence for the structure of nitro and azoxy compounds, a number of substances containing these groups, as well as nitroso compounds, were subjected to the action of zinc ethyl. The structures usually assigned to these groups are as follows:



If nitro and azoxy groups have the structure of formulæ 2 and 5, respectively, compounds containing them should show some resemblance to nitroso compounds (formula 1); whereas if formulæ 3 and 4 are correct this similarity should be lacking. Diethylnitrosamine and phenylmethylnitrosamine do not react with zinc ethyl. Diphenylnitrosamine, however, which contains two aromatic groups, reacts with violence. The resulting product, which contains the amine and zinc alkyl in equal molecular quantities, decomposes with water and diphenylamine, ββ-diethylhydroxylamine, and zinc hydroxide are formed. It is seen, therefore, that the reactive power of the nitroso group is determined by the nature of the groups with which it is united. The reaction between zinc ethyl and nitrosobenzene is a violent one, the chief reaction-products being azoxybenzene and phenylhydroxylamine. A small amount of aniline and ethylaniline is formed, but no diethylaniline could be found. Azoxybenzene does not react with zinc ethyl after long standing; it, therefore, probably has the formula usually assigned to it (number 4). Three nitro compounds were studied. Dimethylnitramine does not react with zinc ethyl; nitroethane readily forms an addition-product, which gives trimethylamine oxide, as pointed out by Bewad, and nitrobenzene reacts but slightly, the bulk of the reaction-product being a neutral, sticky mass of disagreeable character. Taking into consideration the above facts and the general result reached with the nitroso compounds, *viz.*, that negativity and reactiveness are proportional, the conclusion is drawn that nitrobenzene and nitroethane are differently constituted, the former showing the grouping represented by formula 3 above, while the latter contains a pentavalent nitrogen.

Some Derivatives of Camphoroxime. BY G. B. FRANKFORTER AND A. D. MAYO. *Am. Chem. J.*, **21**, 471–473.—Acetyl camphoroxime, $C_{10}H_{16}NO(CH_3CO)$ (b. p. 170°), is formed when camphoroxime is allowed to stand with acetic anhydride. If heat is applied the nitril $C_{10}H_6N$ results. With chloral, in ethereal solution, the reaction-product is chloral camphoroxime $(C_{10}H_{16}NO)_2CHCCl + 2H_2O$, a crystalline powder which melts at 82° and decomposes spontaneously. Succinylcamphoroxime boils with decomposition at 246° and decomposes on standing.

Camphoroxime Derivatives. BY G. B. FRANKFORTER AND P. M. GLASOE. *Am. Chem. J.*, **21**, 474–478.—Phthalic anhydride reacts with camphoroxime in boiling benzene to form an ester which melts with decomposition at 135.5°. Camphorformaldoxime, $C_{10}H_{16}NO.CH_2OH + H_2O$ (m. p. 62°–63°), was prepared by boiling the oxime with an aqueous solution of formic aldehyde and treating the resulting oil with a large quantity of water for several days. If the oil obtained as above is exposed to the sunlight, a part of it is changed into camphorparaformaldoxime, $C_{10}H_{16}N(C_3H_6O_3)$. Monochlorcamphoroxime (m. p. 290°) was formed when an ethereal solution of the oxime was treated with sulphothionyl chloride.

The Composition of Nitrogen Iodide and the Action of Iodine on the Fatty Amines. BY JAMES F. NORRIS AND ARTHUR I. FRANKLIN. *Am. Chem. J.*, **21**, 499–510.—Iodine readily reacts with triethylamine. In ethereal solution triethylamine hydroiodide and the periodide, $(CH_3)_3N.HI.I_2$, are formed; in aqueous solution iodoform is one of the products of the reaction. Tripropylamine forms an addition-product of the formula $(C_3H_7)_3N.I_2$ (m. p. 66°), analogous to the trimethylamine compound already described, and a periodide containing three iodine atoms. With diethyl, diamyl, and methylamine the products were periodides and hydroiodides. From the above facts the conclusion is drawn that iodine readily attacks the amines, causing substitution, and that this is accompanied by the formation of an addition-product of iodine and the amine only in the case of tertiary amines. This conclusion is inconsistent with the formula of nitrogen iodide, $NH_3.I_2$, recently put forward by Chattaway (*J. Chem. Soc.*, **69**, 1572). A number of the arguments adduced in favor of the above formula are answered. The compound prepared by Guthrie (*J. Chem. Soc.*, **1**, 239) and by Seamon (*Chem. News*, **44**, 188), and to which the formula $NH_3.I_2$ was assigned, is probably a mixture of nitrogen iodide and ammonium periodide. This was shown by studying, side by side, the solubility in a number of solvents of such a mixture and the substance prepared as directed by the above authors.

On the Action of Sodic Ethylate on Tribromdinitrobenzol. BY C. LORING JACKSON AND WALDEMAR KOCH. *Am. Chem. J.*, **21**, 510–528.—The constitution of the dinitroresorcinediethyl ether melting at 133°, formed by the action of a hot solution of sodium ethylate on tribromdinitrobenzene $(Br_{3}1,3,5,(NO_{2})_{2}2,4)$, or on the bromdinitroresorcinediethyl ether melting at 184°, was determined by saponifying the ether to the corresponding dinitroresorcine, which proved to be the symmetrical compound $(OH)_{2}1,5,(NO_{2})_{2},2,4$. It follows that the bromine replaced by hydrogen in tribromdinitrobenzene is the one between the two nitro groups, and that the bromdinitroresorcinediethyl ether melting at 184° has the constitution $(OC_{2}H_{5})_{2}1,5,Br3,(NO_{2})_{2}2,4$. An isomeric ether, in which the bromine is not in the ortho position to two nitro groups, gave no replacement of the atom of bromine by hydrogen when treated with sodium ethylate, but gave dinitrophloroglucinetriethyl ether by the replacement of the bromine by an ethoxy group. As a result of the action of sodium ethylate on tribromdinitrobenzene (m. p. 192°) at ordinary temperature in benzene or alcohol solution, the following substances were formed: Two bromdinitroresorcinediethyl ethers, $(OC_{2}H_{5})_{2}1,5,Br3,(NO_{2})_{2}2,4$ (m. p. 184°), and $(OC_{2}H_{5})_{2}1,3,Br5(NO_{2})_{2}2,4$ (m. p. 92), tribromnitrophenol, $Br_{3}1,3,5,NO_{2}2,OH4$ (m. p. 90°), dinitroresorcineethyl ether, $(OC_{2}H_{5})1,OH5,(NO_{2})_{2}2,4$ (m. p. 77°), and dinitrophloroglucinetriethyl ethers, $(OC_{2}H_{5})_{3}1,3,5,(NO_{2})_{2}2,4$. The most striking phenomenon in the action of sodium ethylate on tribromdinitrobenzene at 70° is the replacement by hydrogen of the atom of bromine in the ortho position to both nitro groups, a reaction that takes place to but a slight extent in the cold. The absence of dinitrophloroglucinetriethyl ether when the reaction takes place at 70° is also noteworthy. The mechanism of all the reactions mentioned is explained at length but the discussion cannot be briefly abstracted.

The Action of Sulphocarbanilide on Certain Acid Anhydrides. By Frederick L. Dunlap. *Am. Chem. J.*, 21, 528–531.—When equal molecular quantities of sulphocarbanilide and maleïc anhydride were intimately mixed and heated to 80°–95°, diphenylthiomaleïnuric acid,

$$HOOCCH : CHCONC_{6}H_{5}CSNHC_{6}H_{5},$$

(m. p. 160°) was formed by the direct addition of the two reacting substances. The acid forms crystalline barium, calcium, silver, potassium, and sodium salts. With succinic and phthalic anhydrides no addition-product could be isolated, however. Succinanilic acid, the product of the reaction with the corresponding anhydride, crystallizes from water in prisms which melt at 144.5°–145.5°.

Optical Rotation of Pinen Hydrochloride. By J. H. Long. *J. Am. Chem. Soc.*, 21, 637–642.—It is shown that the effect of temperature on the preparation of pinen hydrochloride from turpentine is unimportant, since the compound prepared below 0° had the same specific rotation as that prepared at 40°. The author holds that turpentine obtained from one tree contains both *d*- and *l*-pinen, and that the different values of the optical rotation of pinen hydrochloride obtained by different observers, are due to the varying proportions of the two varieties in the oils investigated. It is also shown that the separation of *d*- and *l*-pinen cannot be effected by the fractionation of the compounds themselves or their hydrochlorides. The rotation of the hydrochloride prepared from *l*-pinen is greater than that of *l*-pinen, whereas the rotation of the hydrochloride of *d*-pinen is probably somewhat less than that of *d*-pinen. It follows, therefore, that when a *d*-pinen containing some *l*-pinen is treated with hydrochloric acid the rotation of the resulting compound may be reduced to zero. These facts explain the statement of Wallach and Conrady that *d*-pinen is rendered inactive by hydrochloric acid.

Camphoric Acid (Sixth Paper). BY WILLIAM A. NOYES. *Am. Chem. J.*, **22**, 1–5.—The incorrectness of Collie's formula for camphoric acid was established by showing that cis-campholytic acid (isolauronolic acid) and Δ'-tetrahydroxylic acid, $C_6H_6.CH_3(1).COOH(2).CH_3(3)$, are not identical. The neighboring xylic acid was reduced with sodium and amyl alcohol and the corresponding hexahydroxylic acid (m. p. 72°, b. p. 250°–252°) obtained to the extent of about 50 per cent. of the theoretical yield. By treating the reduced acid with phosphorus pentachloride and bromine the chloride of α-bromhexahydroxylic acid, $C_6H_8.CH_3(1).Br.COOH(2).CH_3(3)$, was obtained. This compound is quite stable toward water, is not readily effected by dilute sodium hydroxide, but is decomposed when warmed with glacial formic acid, from which the acid crystallizes in leaflets which melt at 150°–151°. When the α-brom acid is warmed with alcoholic potassium hydroxide, Δ'-tetrahydroxylic acid is formed, which melts at 89°–90° after crystallization from ligroin. This acid differs from other acids of similar structure in that it is not readily oxidized by potassium permanganate.

On Undecylamine and Pentadecylamine and the Preparation of the Higher Amines of the Aliphatic Series. BY ELIZABETH JEFFREYS. *Am. Chem. J.*, **22**, 14–45.—Some time ago Lengfeld and Stieglitz (*Am. Chem. J.*, **16**, 270) showed that sodium methylate in methyl alcohol solution converts acid bromamides into urethanes according to the reaction

$$RCONHBr + CH_3ONa = RNHCOOCH_3 + NaBr.$$

The author shows that the resulting urethanes are converted quantitatively into amines when distilled with slaked lime, and that the reaction serves as an excellent method of preparing the higher aliphatic amines, which are obtained with difficulty by the older methods. The process is a simple one, since the urethanes are obtained without the isolation of the brom- or chloramides by the action of a sodium alcoholate on a mixture of the acid amide and bromine. The method is applicable to the preparation of both aliphatic and aromatic urethanes, in ethyl and methyl alcohol solution, but cannot be used when the acid amide is unsaturated or otherwise very susceptible to bromine. The amines obtained by this method were shown to be primary monoalkyl amines by the preparation of a mustard oil and an isocyanate from pentadecylamine, and by the formation of primary alcohols when sodium nitrite was allowed to act upon the amine hydrochlorides. In the preparation of the higher amines by the Hofmann reaction acyl alkyl ureas are formed to a large extent. This is shown to take place whenever, owing to the slowness of the reaction, considerable unchanged acid amide is present, while the remainder of the acid amide is suffering rearrangement; the rearranged portion then reacts with the unchanged amide even in the presence of alcohol or water and forms a urea. This is remarkable, inasmuch as isocyanates, the probable intermediate products in the Beckmann rearrangement, under ordinary circumstances do not act upon an acid amide in the presence of alcohol or water. Palmitic chloramide (m. p. 70°–71°), prepared by the action of sodium hypochlorite on palmitic amide, was obtained as a white precipitate and converted by sodium methylate into methyl pentadecylurethane which crystallizes in leaflets melting at 61°–62°. This compound, as well as methyl phenylcarbamate and methyl *m*-nitrophenylcarbamate were prepared from the amides directly by the action of a mixture of bromine and sodium methylate. Normal pentadecylamine hydrochloride, prepared from the free amine (obtained by distilling pentadecylurea with lime), crystallizes in leaflets which decompose at 200° without melting. The chlorplatinate decomposes at 205°. The corresponding urea (m. p. 109°) was prepared from the hydrochloride and potassium cyanate. Pentadecylamine crystallizes in leaflets, melts at 36.5°, boils at 298°–301°, and rapidly absorbs carbon dioxide and water. Its benzoyl derivative melts at 78°. The amine was shown to be a primary one by the action of carbon disulphide, phosgene, and sodium nitrite. In ether solution carbon disulphide gave pentadecylamine pentadecyldithiocarbamate (m. p. 99°) which, when heated in a sealed tube, was converted into dipentadecylthiourea (m. p. 88.5°). Pentadecyl mustard oil was prepared in impure condition by heating pentadecylamine, in solution in absolute alcohol, with an excess of carbon disulphide. The mustard oil was identified by treating it with aniline, when phenylpentadecylthiourea (m. p. 79°) was obtained. By the action of phosgene on the amine hydrochloride pentadecylurea chloride, $C_{15}H_{31}NHCOCl$, was obtained. The compound is unusually stable for substances of this class; it can be heated for several hours at 100°–150° without losing all of its hydrogen chloride. Pentadecylisocyanate (m. p. 8°–14°) was prepared by dissolving the urea chloride in benzene and heating it with calcium oxide. Dipentadecylurea (m. p. 113°) was obtained by heating the isocyanate with pentadecylamine. With sodium nitrite pentadecylamine hydrochloride gave a mixture of the corresponding alcohol and the hydrocarbon $C_{15}H_{30}$. Pentadecylphenylcarbamate (m. p. 72°) was formed when the alcohol and phenyl isocyanate were allowed to stand together. In order to find whether the methods described for obtaining urethanes and amines are general for amides of high molecular weight, the same reactions were carried out with stearic and lauric amides. The preparation of the following compounds showed that the reactions are general: Stearic chloramide (m. p. 63°–64°), methyl heptadecylcarbamate, heptadecylamine, methyl undecylcarbamate (m. p. 45°–47°), undecyllaurylurea (m. p. 105°), undecylamine hydrochloride, undecylamine chlorplatinate decomposing at 190°, normal undecylamine (m. p. 15°, b. p. 232°), benzoylundecylamine (m. p. 60°), normal undecyl alcohol (m. p. 19°, b. p. 131° at 15 mm.), undecylphenylcarbamate (m. p. 62°), undecylene (b. p. 84° at 18 mm.), and undecylene dibromide (b. p. 161° at 18 mm.).

On Certain Derivatives of Symmetrical Trichlorbenzol. BY C. LORING JACKSON AND F. H. GAZZOLO. *Am. Chem. J.*, **22**, 50–61.—In a previous paper Jackson and Calvert (*this Rev.*, **2**, 76) showed that when tribromiodobenzene, $Br_3 1,3,5,I2$, and tetrabrombenzene, $Br_4 1,2,3,5$, were treated with sodium ethylate, the halogen in position 2 was replaced by hydrogen. The investigation of the corresponding trichlor derivatives has now been made. Trichloriodobenzene, $Cl_3 1,3,5,I2$ (m. p. 55°) and sodium ethylate gave symmetrical trichlorbenzene. With fuming nitric acid trichlordinitrobenzene (m. p. 129°) was formed, iodine being set free. Trichlorbrombenzene, $Cl_3 1,3,5,Br2$, melts at 65°, loses bromine with sodium ethylate, and with fuming nitric acid gives trichlorbromdinitrobenzene, melting at 175°, which is a decidedly reactive substance. Aniline replaced three atoms of chlorine, giving trianilidobromdinitrobenzene melting at 175°–176°. With sodium ethylate a number of compounds are formed, from which bromdinitroresorcinediethyl ether (m. p. 81°–82°), having the probable structure $(C_2H_5O)_2 1,3, Br2(NO_2)_2 4,6$, was separated in pure condition. The formation of this compound is interesting in that it is the first case noted in which chlorine has been replaced by hydrogen under these conditions.

Narcotine and Narceine. By George Bell Frankforter and Frank H. Keller. *Am. Chem. J.*, **22**, 61–67.—The authors doubled the yield of narceine obtained from narcotine-methyl iodide by converting the latter into the chloride by means of chlorine water instead of silver chloride. The secondary product obtained when the old method is used is probably the compound $C_7H_6(CH_3)_2N_2Cl.2AgI$. When chlorine water is used the by-product of the reaction is narcotine-methyl triiodide $C_{22}H_{23}I_2NO_7CH_3I$ (m. p. 149°). When this compound is treated with an excess of chlorine water, methylnornarcotine-methyl triiodide, $C_{20}H_{21}I_2NO_7.CH_3I$ (m. p. 186°), is formed. Narcotine methyl chloride forms a double salt with platinic chloride, which melts at 221°.

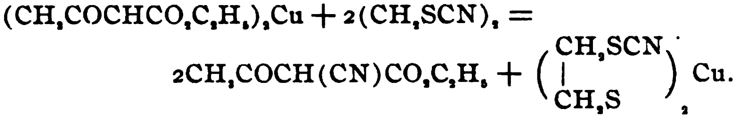
The Reaction between Aliphatic Sulphocyanates and Metallic Derivatives of Acetoacetic Ester and Analogous Substances. By Elmer P. Kohler. *Am. Chem. J.*, **22**, 67–80.—The primary reaction between the metallic derivatives of the esters of ketonic acids and aliphatic sulphocyanates results in the formation of a mercaptide and a cyanogen substitution-product of the ester. The final result depends, to some extent, upon the ester, the metal, and the sulphocyanate. If the resulting mercaptide is soluble in the liquid used as a medium, it immediately reacts with the unchanged sulphocyanate to form a disulphide. A typical reaction is represented by the following equation :

$$CH_3COCNaC_2H_5COOC_2H_5 + 2C_2H_5SCN = \\ CH_3COC(CN)C_2H_5COOC_2H_5 + (C_2H_5S)_2 + NaCN.$$

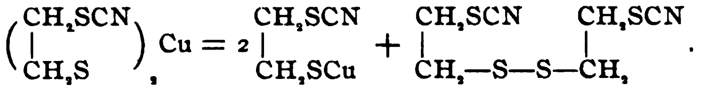
In case the cyanogen derivative formed contains hydrogen that is replaceable by metal, it passes into a metallic derivative by liberating a corresponding amount of the original ester. With sodium derivatives, the sodium mercaptides formed slowly saponify the original esters and the cyanogen derivatives resulting from the reaction. With copper derivatives the reactions are clean, as the copper mercaptides are insoluble in organic liquids and inert. The following equation represents a typical reaction :

$$4(CH_3COCHCO_2C_2H_5)_2Cu + 4C_2H_5SCN = \\ 2(CH_3COC(CN)CO_2C_2H_5)_2Cu + 4CH_3COCH_2CO_2C_2H_5 + \\ (C_2H_5S)_2 + 2C_2H_5SCu.$$

The reaction between copper derivatives and polysulphocyanates that have but one sulphocyanogen group with any one carbon atom, normally involves only one of the sulphocyanogen groups; the remainder are protected by the insolubility of the resulting mercaptide. Ethylene sulphocyanate and copper acetoacetic ester, for example, in the cold, react according to the equations:

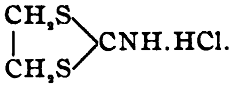
I. 

$$(CH_3COCHCO_2C_2H_5)_2Cu + 2(CH_2SCN)_2 = 2CH_3COCH(CN)CO_2C_2H_5 + \left(\begin{array}{l}CH_2SCN\\ |\\ CH_2S\end{array}\right)_2 Cu.$$

II. 

$$\left(\begin{array}{l}CH_2SCN\\ |\\ CH_2S\end{array}\right)_2 Cu = 2\begin{array}{l}CH_2SCN\\ |\\ CH_2SCu\end{array} + \begin{array}{lcl}CH_2SCN & & CH_2SCN\\ | & & |\\ CH_2—S & — & S—CH_2\end{array}.$$

The sulphocyandisulphides thus formed are soluble in organic solvents and at higher temperatures react like simpler polysulphocyanates. By adding the sulphocyanate, in very small quantities, to a saturated solution of the copper derivatives, all of the sulphocyanogen groups can be brought into reaction. When polysulphocyanates have two sulphocyanogen groups in combination with the same carbon atom, both of them enter into reaction under all conditions. A difference in behavior with copper and sodium derivatives is observed in the case of halogen substitution-products of the sulphocyanates. With the former chlorethylsulphocyanate reacts, the halogen not taking part in the reaction. With the latter, two reactions take place simultaneously—the normal reaction of the sulphocyanates and the general reaction of halogen substitution-products. Copper cyanacetoacetic ester crystallizes from alcohol in green plates, which melt with decomposition at about 250°. The compound of the formula $CuSCH_2.CH_2SCN$, formed by the action of ethylene sulphocyanate on copper acetoacetic ester, when boiled with concentrated hydrochloric acid, gives iminomethene-ethenedisulphide hydrochloride,



$$\begin{array}{l}CH_2S\\ |\\ CH_2S\end{array}\!\!>\!CNH.HCl.$$

The compound represented by the formula $(NCSCH_2.CH_2S)_2$ is a colorless liquid which does not solidify at —20° and does not boil without decomposition. When warmed with strong potassium hydroxide it is converted into ethylenetetrasulphide. The mercaptide $CuSCH_2.S.CH_2SCu$ is a light yellow impalpable powder. Cyanethylacetoacetic ester boils at 130° at 35 mm. pressure, and sulphocyanethylacetoacetic ester,

$$CH_3COC(CH_2CH_2SCN)CHCO_2C_2H_5,$$

crystallizes in colorless, transparent plates, which melt at 83°.

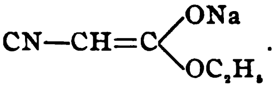
On Nitromalonic Aldehyde. BY HENRY B. HILL AND JOSEPH TORREY, JR. *Am. Chem. J.*, **22**, 89–110.—When mucobromic acid is added to a solution of sodium nitrite in dilute alcohol a vigorous reaction takes place with rise in temperature, evolution of carbon dioxide, and change in color of the solution to a deep red. From the cooled reaction-mixture sodium nitromalonic aldehyde, $NaC_3H_2NO_4.H_2O$, crystallizes in needles. The free aldehyde (m. p. 50°–51°) was obtained by treating its silver salt suspended in ether with an ethereal solution of hydrogen chloride. The constitution of the compound was established by the reactions and condensations of the aldehyde described below. When aniline hydrochloride was added to an aqueous solution of the sodium salt of the aldehyde, an anil was formed in which an oxygen of the aldehyde groups had been replaced by the radical $=N.C_6H_5$. The compound crystallizes in yellow scales, which melt at 143°–144°. If aniline is used the dianil (m. p. 93°–94°) results. Analogous compounds were prepared with *p*-toluidine, *o*-toluidine, methylamine, ethylamine, isoamylamine, and phenylhydrazine. The phenylhydrazone melts at 101°, and is converted by heating in alcoholic solution at its melting-point into 1-phenyl-4-nitropyrazol, melting at 126°–127°. The latter compound was also obtained where the diphenylhydrazone (m. p. 98°) was heated. The diphenylhydrazone yields stable sodium and lead salts. Hydrazine sulphate and an aqueous solution of sodium nitromalonic aldehyde produced a dark red precipitate which, when decomposed with hydrochloric acid, gave as one of the decomposition-products 4-nitropyrazol. The constitution of the phenylnitropyrazol mentioned above was thus established. In neutral solution hydroxylamine hydrochloride and sodium nitromalonic aldehyde give β-nitroisoxazol (m. p. 46°–47°), in alkaline solution two molecules of the hydroxylamine enter into the reaction and the sodium salt of a dioxime is formed. This sodium salt is readily converted into a silver salt, and when treated with aniline hydrochloride is changed into nitromalonic aldehyde aniloxime (m. p. 162°). Sodium nitromalonic aldehyde condenses with acetone in alkaline solution and forms a compound which yields *p*-nitrophenol. The aldehyde condenses also with methyl-ethyl ketone, giving nitro-*o*-cresol, with benzyl ketone, giving a nitrophenol derived from *m*-diphenyl benzene, with acetoacetic ester, giving nitrosalicylic acid, and with acetone dicarboxylic acid giving nitrooxyisophthalic acid. When a solution of the sodium salt of nitromalonic aldehyde was acidified with one molecular quantity of hydrochloric acid and allowed to stand some time, symmetrical trinitrobenzene crystallized out, and formic acid appeared in the solution. It seems probable that the trinitrobenzene is formed by the spontaneous condensation of nitroacetaldehyde, which is first formed together with formic acid by the addition of water to the nitromalonic aldehyde.

On the Rearrangement of the Thioncarbamic Esters. By H. L. Wheeler and Bayard Barnes. *Am. Chem. J.*, **22**, 141–152.—When a thioncarbamic ester, $H_2N.CS.OR$, is treated with an alkyl halide, it is converted into a thiolcarbamic ester, $H_2N.CO.SR$. This rearrangement is the result of the addition of the halide to the thion compound, either at the double bond or to the sulphur atom, and the subsequent elimination of the halogen atom with the alkyl group originally present in the thion ester. In this way methyl and ethyl thioncarbamate were changed into methyl thiolcarbamate when allowed to stand with methyl iodide. This rearrangement was shown to be a general reaction by preparing from the corresponding thioncarbamates the following thiolcarbamates: methyl (m. p. 107°–108°), ethyl (m. p. 107°–108°), isobutyl (m. p. 102°–103°), and isoamyl (m. p. 112°–113°). The isopropyl derivative (m. p. 125°) was made from the isoamyl compound. When ethyl thioncarbamate was treated with ethylene bromide both bromine atoms took part in the reaction, the ethylene ester of thiolcarbamic acid being formed. Since the alkyl halides readily change thion into thiol compounds the arguments put forward for the structure of some thiol acids, based on the action of ethyl bromide on their salts, no longer hold. The salt formed by the action of carbon oxysulphide on ammonia is probably a thion compound and not a thiol derivative, although it gives with ethyl bromide ethyl thiolcarbamate. The work suggested that a rearrangement might be effected in the case of tetravalent sulphur compounds by alkyl halides. This was found not to be the case with the esters of sulphinic acids and with alkyl sulphites.

Dimethyldianthracene: A Polymeric Modification of β-Methylanthracene. By W. R. Orndorff and H. A. Megraw. *Am. Chem. J.*, **22**, 152–157.—In a previous paper (*this Rev.*, **2**, 77) it was shown that anthracene and anthranol, when suspended in benzene and exposed to sunlight, were rapidly polymerized to compounds which had twice the molecular weight of the original substances. Under the same conditions, from β-methylanthracene a white crystalline substance is formed, which melts with slight decomposition at 228°–230° after several recrystallizations from toluene. The compound has the same percentage composition as β-methylanthracene but twice its molecular weight. It is therefore, dimethyldianthracene. The new hydrocarbon does not show the fluorescence characteristic of anthracene and methyl anthracene, and does not form an addition-compound with picric acid. It probably crystallizes in the orthorhombic system and is changed into β-methylanthracene at its melting-point.

Action of Sulphuric Acid on Nitroheptane. By R. A. Worstall. *Am. Chem. J.*, **22**, 164–167.—When nitroheptane was treated with dilute or concentrated sulphuric acid the products of the reaction were heptoic acid and ammonia. When, however, fuming sulphuric acid was used a small amount of nitroheptane sulphonic acid was also formed. The acid which could not be purified was separated by means of its barium salt, which crystallizes in small reddish-yellow plates. An attempt was made to prepare a sulphonic acid by acting upon bromnitroheptane with sodium sulphite, but without success.

On Alkyl Malonic Nitriles and Their Derivatives. By John C. Hessler. *Am. Chem. J.*, **22**, 169–198.—The author describes in detail the preparation and reactions of a number of alkyl malonic nitriles and their derivatives. When sodium cyanacetic ester was treated with ethyl iodide in alcoholic solution, the yield of ethyl cyanacetic ester was 74 per cent. of the theoretical, and about one-fourth of the reaction-product was diethylcyanacetic ester. When no solvent was used the yield of the disubstitution-product was decreased about one-half. Ethylcyanacetamide (m. p. 113°, b. p. 180°–190° at 24 mm.) and diethylcyanacetamide (m. p. 122°) were prepared from the corresponding esters. Ethylcyanacetic acid is a hygroscopic liquid, which boils at 160°–161° at 24 mm. and forms a white crystalline silver salt. By treating dry sodium cyanacetic ester with ethyl iodide a much larger yield of benzylcyanacetic ester (b. p. 176°-185° at 21 mm.) is obtained than when alcohol is used as solvent. Dibenzylcyanacetic ester, which is obtained at the same time, melts at 33°. From analogy with other compounds of the same class the sodium salt of cyanacetic ester has probably the constitution represented by the following formula:



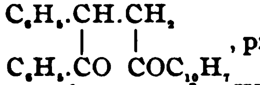
$$CN{-}CH{=}C\begin{cases}ONa\\OC_2H_5\end{cases}.$$

Benzylcyanacetamide (m. p. 130°) is converted into benzylmalonic nitrile (m. p. 91°) by phosphorus pentachloride. When the sodium salt of the nitrile was heated under diminished pressure hydrocinnamic nitrile was formed. The formation of an inorganic cyanide, when the sodium and silver salts of the nitrile are heated, is evidence for the following formula for the salts: $C_6H_5CH_2(CN)C{=}C{=}N.M$. The sodium and silver salts of ethylmalonic nitrile (b. p. 200°) behave in the same way when heated, but it was found impossible to separate in pure condition any organic substance formed in the decomposition. When malonic nitrile was heated with alcoholic sodium ethylate and benzyl chloride the resulting mixture of the mono- and dibenzyl substitution-products contained 90 per cent. of the latter compound. When the dry sodium salt of the nitrile was used the yield of the mono derivative was increased. Benzylcyanacetic acid melts at 101°–102° and gives a white insoluble silver salt. Benzoylbenzyl nitrile melts at 100° and is converted into benzylmalonic nitrile and ethyl benzoate when boiled with alcohol. Brombenzylmalonic nitrile (m. p. 119°–120°) was prepared by brominating sodium benzylmalonic nitrile. From the sodium salt carbethoxybenzylmalonic nitrile (m. p. 44°–45°) was prepared by the action of chlorcarbonic ether, and methylbenzylmalonic nitrile (m. p. 94°–95°) by the action of methyl iodide. By the action of methyl iodide and alcoholic sodium ethylate on benzylmalonic nitrile, methylbenzylcyanacetimidoethyl ester (b. p. 170° at 22 mm.) was formed and not the nitrile, which is usually formed by this reaction. The corresponding ethyl derivative (b. p. 170° at 22 mm.) was prepared from benzylmalonic nitrile and ethyl iodide, and from ethylmalonic nitrile and benzyl chloride. Phenylacetamidoethyl ester, prepared from the chloride by the method of Bushong, boils at 105°–106° at 10 mm. Monimidomalonic ester, made from cyanacetic ester by the method of Pinner, decomposes when heated to 165° at ordinary pressure.

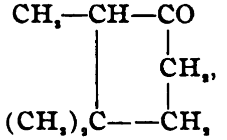
On the Phenylhydrazones of Benzoin. BY ALEXANDER SMITH. *Am. Chem. J.*, **22**, 198–207.—Some time ago Smith and Ransom (*Am. Chem. J.*, **16**, 108) described the preparation and properties of a substance formed by the interaction of phenylhydrazine and benzoin, which differed in physical properties, although not in chemical properties and composition, from the phenylhydrazone which was known at that time. The relation between these two bodies has been recently investigated by Freer (*this Rev.*, 5, 32) who obtained results not in accord with those obtained by Smith and Ransom. Freer found that the bodies behave differently towards benzoyl chloride and nitrous anhydride, and from these facts came to the conclusion that the compounds are not stereoisomers, but are structurally different, one being a hydrazo derivative and the other a hydrazone. The author has repeated the work of Smith and Ransom and finds nothing to modify in their published statements. It is also shown that the substance described by Freer as γ-phenylhydrazone is benzanilide, and that the two phenylhydrazones of benzoin show the same behavior when treated with benzoyl chloride and with nitrous anhydride. There is no evidence, therefore, against the stereochemical explanation of the isomerism of the hydrazones.

Disulphones and Ketosulphones. BY ELMER P. KOHLER AND MARGARET B. MACDONALD. *Am. Chem. J.*, **22**, 219–227. —The sodium salts of sulphinic acids react readily with acid chlorides, giving substances of a new class: with sulphone chlorides, disulphones $RSO_2—SO_2R$, and with the chlorides of the carbonic acids, ketosulphones $RCO—SO_2R$ are formed. The disulphones are remarkably inert; they are not changed by boiling with dilute acids or alkalies and can be crystallized without loss from concentrated nitric acid. They are broken down, however, when boiled with concentrated potassium hydroxide into a sulphinate and a sulphonate. Di-*p*-tolyldisulphone is insoluble in water and alcohol and crystallizes from benzene in monoclinic tables, which melt with decomposition at 212°. Phenyl-*p*-tolyldisulphone (m. p. 166°) and *p*-tolyl-*p*-nitro-*o*-tolyldisulphone (m. p. 154°) were also prepared and studied. Phenyl-*p*-tolylketosulphone, $C_6H_5CO—SO_2C_6H_4.CH_3$, formed by the action of benzoyl chloride on sodium toluenesulphinate, was found to be a very reactive substance, which formed addition-products with water, hydrogen potassium sulphite, and hydrocyanic acid, and showed the usual ketone reactions with hydroxylamine, phenylhydrazine, primary amines, and phenols. The hydrate of the compound melts at 80° and decomposes before the water is driven off.

The Reaction between Sulphone Chlorides and Metallic Derivatives of Ketonic Esters. BY ELMER P. KOHLER AND MARGARET B. MACDONALD. *Am. Chem. J.*, **22**, 227–239.—The reaction between toluene sulphone chloride and the sodium derivative of acetoacetic ester is much more complicated than the analogous reaction with the chlorides of the carbonic acids. With the sulphone chloride the primary reaction consists in the interchange of sodium and chlorine with the formation of sodium toluenesulphinate and chloracetoacetic ester. The latter compound then reacts with some of the unchanged sodium derivative to form diacetosuccinic ester and sodium chloride. The chlor ester also reacts with the sodium toluenesulphinate forming toluenesulphoneacetoacetic ester, which in turn reacts with the alcohol present and forms toluenesulphonacetic ester. Although it was found impossible to isolate toluenesulphoneacetoacetic ester, its sodium derivative was prepared in small quantity as the result of a secondary reaction between the sodium derivative of acetoacetic ester and the ethyl ester of toluenethiosulphonic acid, the primary reaction being the formation of sodium toluenesulphinate, diacetosuccinic ester, and ethyl disulphide. The products of the reaction between toluenesulphone chloride and sodium malonic ester were sodium toluenesulphinate and sodium toluenesulphoneacetic acid. With disodium malonic ester, a salt of the composition $C_7H_7SO_2CNa.CO_2Na.CO_2C_2H_5$ was formed, which was decomposed into toluenesulphonacetic ester by hydrochloric acid. The course of the reaction between sodium toluenesulphinate and chloracetoacetic ester was found to depend upon the temperature and concentration. In cold dilute solutions an acetyl or carbethoxyl group is replaced by the sulphone group; in boiling concentrated solutions the sulphinate is oxidized and the chlor ester reduced.

On Potassium Cyanide as a Condensing Agent. By ALEXANDER SMITH. *Am. Chem. J.*, **22**, 249–256.—Condensation of benzoin with ketones is readily effected by means of potassium cyanide. The reaction takes place in alcoholic solution, but a better yield is obtained when the substances are fused with the cyanide. Desyl-α-acetonaphthone,  $\begin{array}{l} C_6H_5.CH.CH_2 \\ \qquad\quad | \qquad | \\ C_6H_5.CO \;\; COC_{10}H_7 \end{array}$, prepared from benzoin and α-acetonaphthone melts at 151°. When treated with cold concentrated sulphuric acid it is converted into diphenyl-α-naphthylfurfurane (m. p. 96°), and when heated with alcoholic ammonia in a sealed tube diphenyl-α-naphthylpyrrol (m. p. 122°) is formed. Desyl-β-naphthone melts at 155°. When benzaldehyde was heated to 150° with powdered potassium cyanide a good yield of benzoin was obtained. Desylacetophenone and desyl-α-acetonaphthone were easily prepared by condensing by means of powdered potassium cyanide or potassium hydroxide. The yield of desylacetomesitone (m. p. 115°) was 61 per cent. of the theoretical, when benzoin and acetomesitone were heated at 150° with potassium hydroxide. Diphenylmesitylfurfurane (m. p. 87°) and diphenylmesitylpyrrol (m. p. 188°) were prepared by the usual reactions from desylacetomesitone. When a fused mixture of benzyl cyanide and benzoin were heated with potassium cyanide there were obtained, in addition to the reaction-product formed when alcoholic solutions were used, benzalbenzyl cyanide, diphenylsuccinic nitrile, and a yellow amorphous substance, which was not investigated.

Camphoric Acid. By WILLIAM A. NOYES. *Am. Chem. J.*, **22**, 256–266.—The author shows that facts established by himself and by others indicate that the formula of camphoric acid proposed by Perkin (*Proc. Chem. Soc.*, 1896, 191) and by Bouveault, which represents the compound as a derivative of succinic acid, is probably correct. The results of a study of the ketone $C_8H_{14}O$, prepared by Noyes and Harris (*this Rev.*, 3, 12), give further evidence of the correctness of this view. The synthesis of this ketone from isoamyl bromide was attempted but has not been completed. Amyl bromide, from the amyl alcohol of fusel oil, was converted into isocaproic acid, which was oxidized to isocaprolactone. From this compound was prepared γ-bromisocaproic ester, which yielded with sodium ethylate and cyanacetic acid a small amount of dimethylcyancarboxethylcyclopentanone, an unsaturated fatty acid being formed at the same time. This ketone melts at 148.5°, and when heated in a sealed tube with water at 150°–160° loses the cyanogen group. (With J. W. SHEPHERD.) Dihydrociscampholytic acid was converted into the chloride of the α-brom acid by treatment with phosphorus pentachloride and bromine. The ethyl ester, prepared from the chloride, was shaken with a solution of barium hydroxide. The hydroxy acid (m. p. 112°) so prepared was converted into the ketone $C_8H_{14}O$, mentioned above, by distillation with lead peroxide and sulphuric acid. The ketone boils at 167°–169° and forms an oxime which melts at 104°. It, in all probability, is a cyclopentanone, and has the formula



for it condenses with but one molecule of benzoic aldehyde to form the compound $C_8H_{12}O{=}CHC_6H_5$ (m. p. 74°).

Researches on Substitution: The Action of Bromine on Metachlor-, Metabrom-, and Metaiodoanilines. BY H. L. WHEELER AND WILLIAM VALENTINE. *Am. Chem. J.*, **22**, 266–280.—When *m*-bromaniline, dissolved in glacial acetic acid, was treated with an equal molecular quantity of bromine, the product obtained in largest amount was 3,4-dibromaniline; next in amount was 3,4,6-tribromaniline; then followed 2,3,4-tribromaniline and a small quantity of 2,3,4-6-tetrabromaniline. The bromination of *m*-chlor- and *m*-iodoanilines gave similar results. It follows, therefore, when bromine acts upon aniline which contains a halogen atom in the meta position, it substitutes the hydrogen in the order 4, 6, and 2. Previous work has shown that position 6 is the most favored for an entering halogen atom in *m*-nitroaniline. As a result of the work the following substances were prepared: 3-chlor-4-bromaniline (m. p. 67°–68°) and its hydrochloride, sulphate, and picrate; nitrochlorbrombenzene, NO_2ClBr,1,4,3 (m. p. 49°–50°); 3-chlor-4-brom-2,6-dinitraniline (m. p. 169°–170°); 3-chlor-4-bromacetanilide (m. p. 125°); 3-chlor-4-brom-6-nitroacetanilide (m. p. 129°–130°); 3-chlor-4-brom-6-nitraniline (m. p. 202°–203°); 4-chlor-3-bromnitrobenzene (m. p. 60°); 4-chlor-3-bromaniline (m. p. 78°); 3-chlor-4,6-dibromaniline (m. p. 79°–80°); 3-chlor-2,4,6-tribromaniline; 3,4-dibromaniline (m. p. 80°–81°) and its hydrochloride, picrate, and sulphate; 3,4,6-tribromaniline (m. p. 85°-86°); 1,3,4-tribrombenzene (m. p. 44°); 3,4,6-tribromacetanilide (m. p. 188°–189°); 3,6-dibromacetanilide (m. p. 171°–172°); 3-iod-4-bromaniline (m. p. 77°) and its hydrochloride, sulphate, and picrate; 3-iod-4-acetanilide (m. p. 138°–139°); 3-iod-4,6-dibromaniline (m. p. 81°); 3-iod-2,4,6-tribromaniline (m. p. 115°–116°).

Upon the Action of Diazo Compounds on Thymolparasulpho Acid. By James H. Stebbins, Jr. *J. Am. Chem. Soc.*, **21**, 741–746.—By the action of diazonaphthionic acid on *p*-thymolsulphonic acid, a substance which had a crimson-red color and an azo compound were formed. The latter compound was isolated in the form of its barium salt, which probably has the formula $baSO_3.C_{10}H_6N=NC_{10}H_{12}O.SO_3ba$.

Halides and Perhalides of the Picolines. By Paul Murrill. *J. Am. Chem. Soc.*, **21**, 828–854.—A large number of salts were prepared which resemble closely in composition and properties analogous compounds of this class.

An Electrolytic Study of Benzoin and Benzil. By Joseph H. James. *J. Am. Chem. Soc.*, **21**, 889–911.—The electrolytic oxidation of benzoin in sodium hydroxide solution yielded benzoic acid and tarry decomposition-products. In sulphuric acid the same result was obtained, but in the presence of hydrochloric acid benzil was also formed. The electrolytic reduction of benzoin gave a body, the nature of which was not established, but which differed from the compounds formed by the reduction of benzoin by sodium amalgam or zinc and hydrochloric acid. The electrolytic oxidation of benzil gave benzoic acid when the solvent was sulphuric acid. In other cases either no oxidation took place or tarry products were formed. The electrolytic reduction of benzil in sodium hydroxide solution gave nothing definite, but in sulphuric acid a good yield of almost pure benzoin was obtained. From the above it is seen that electrolytic oxidation and reduction give practically the same result as those obtained by chemical means, but not so readily or with as good yield.

The Chromic Acid Test for Cocaine. By George L. Schaefer. *J. Am. Chem. Soc.*, **21**, 936–938.—The author replies to criticisms of the test proposed by him and gives further directions for its use.

The Action of Sodium Methylate upon Dibromides of Propenyl Compounds and of Unsaturated Ketones. By F. J. Pond, O. P. Maxwell, and G. M. Norman. *J. Am. Chem.*

Soc., **21**, 955–967.—In a former paper (*this Rev.*, 4, 9) it was shown that certain ethers which contain a propenyl group readily form dibromides, which are converted into ketones on treatment with sodium methylate. It is shown in the present paper that isoapiol and propyl isoeugenol undergo similar transformations and that dibromides of certain unsaturated ketones of the formula R—CH=CH—CO—C_6H_5 may be readily changed into 1,3-diketones.

The Electrolytic Oxidation of Succinic Acid. By Charles H. Clarke and Edgar F. Smith. *J. Am. Chem. Soc.*, **21**, 967–972.—When a solution of succinic acid in sodium hydroxide or alcohol was subjected to the action of electrolytic oxygen the following substances were formed: tartaric acid, oxalic acid, oxygen, carbon monoxide, carbon dioxide, ethylene, methane, and some aromatic bodies which were not studied.

On β-Heptylamine. By Thomas Clarke. *J. Am. Chem. Soc.*, **21**, 1027–1032.—β-heptylamine was prepared by heating β-heptyl bromide with ammonia in a sealed tube. Heptylene was produced as a secondary product. The hydrobromide, hydrochloride, oxalate, and double salts of the amine with platinic and auric chlorides are described.

Hydrogen Peroxide as a Test for Salicylic Acid. By W. E. Ridenour. *Am. J. Pharm.*, 71, 414–416.—A dilute solution of sodium salicylate gives a cherry-red color when treated with hydrogen peroxide in the presence of an ammoniacal solution of ammonium carbonate. One part of acid in 2,000 parts of water can be detected in this way. The conditions necessary for the reaction and a table showing the influence of a large number of chemicals are given.

Acet-*p*-sulphanilate of Sodium. By Geo. W. Funck. *Pharm. Rev.*, 17, 249–254.—The author gives a review of all the work done on the above compound. This includes a complete bibliography of the salt and an account of its history, formation, preparation, and physical, chemical, and therapeutic properties.

Acetanilide. By Charles W. Gorr. *Pharm. Rev.*, 17, 295–305.—This article consists mainly of a résumé of the present knowledge concerning the modes of formation and of preparation, and the chemical and physical properties of acetanilide.

GEOLOGICAL AND MINERALOGICAL CHEMISTRY.

M. L. FULLER, REVIEWER.

Analysis and Composition [of Roscoelite]. By W. F. Hillebrand. *Am. J. Sci.*, 157, 451–454.—Samples of this vanadium mica from Eldorado County, California, were analyzed by the author with a view of reconciling the discrepancies between the analyses of Roscoe and Genth, and of establishing a satisfactory formula. A detailed description of the methods used in the determination of vanadium is given. The analyses varied from those of Roscoe in that no manganese or calcium was found, and from those of Genth in having over three per cent. more V_2O_5.

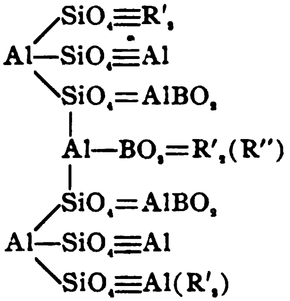
Chemical Constitution of Roscoelite. BY F. W. CLARKE. *Am. J. Sci.*, 157, 454–455.—From the analysis of Hillebrand the author has calculated the empirical formula to be

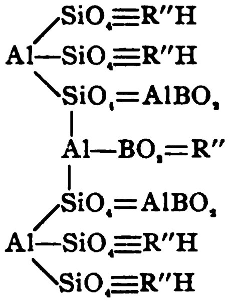
$$H_{456}K_{220}Fe_{22}Mg_{41}Al_{226}V_{318}Si_{763}O_{2724}.$$

Considering the groups SiO_4 and Si_3O_8 to be replaceable, the formula reduces to $R'_{676}R''_{63}Al_{226}V_{318}(SiO_4)_{626}(Si_3O_8)_{71}$, which would indicate, according to Clarke's mica theory, a mixture of three molecules, representing respectively a normal phlogopite, a trisilicate alkaline biotite, and a vanadium muscovite, the last forming 74.5 per cent. of the whole mass.

On the Chemical Composition of Parisite and a New Occurrence of it in Ravalli County, Montana. BY S. L. PENFIELD AND C. H. WARREN. *Am. J. Sci.*, 158, 21–24.—The parisite occurs in a fine-grained, friable white substance resembling decomposed rhyolite or trachyte, and is associated with numerous pyritohedrons of pyrite. It crystallizes in rather long hexagonal shafts, made up of pyramids in oscillatory combination, and terminated by distinct, somewhat enlarged pyramids. A study of the analysis made by the authors indicates that parisite is probably a double carbonate of the formula $2(RF)CO_2.CaCO_3$ or $(RF)_2Ca(CO_3)_3$ in which R=Ce, La, Di, etc.

The Constitution of Tourmaline. BY F. W. CLARKE. *Am. J Sci.*, 158, 111–121.—Upon reducing to a common basis of six silicon atoms, the formula $H_{11}Al_3B_2Si_4O_{21}$ of Penfield and Foote becomes $H_{16.5}Al_{4.5}B_3Si_6O_{31.5}$, while that of Clarke is $H_{14}Al_8B_3Si_6O_{31}$. The author holds the view that these slight differences amount to no more than the uncertainties of the analyses, and in support of this view gives a series of formulæ computed from Rigg's data, which show variations beyond both extremes, and make it probable that neither formula can be accepted without qualification as final. The intimate relation of tourmaline to mica is indicated by the alteration of the former to mica, by the parallelism in composition between the two when they occur together, and by the similarity in the commingling of isomorphous molecules in the two groups. Allied to muscovite, $Al_3(SiO_4)KH_2$, is $Al_5(SiO_4)_6(BO_2)_2.BO_2H_2.H_{12}$, the tourmaline acid, in which the H may be replaced by Ca, Mg, Na, and Al. Numerous examples of mixtures of isomorphous molecules of this tourmaline acid are given. The formulæ advanced by the author as covering all established variations in composition and rendering intelligible the various isomorphous mixtures, are as follows:





The objection to these formulæ, and also to that of Penfield and Foote as well, is that the end products contain no alkalies, while in reality an alkali-free tourmaline is unknown. Assuming these formulæ, the variations from the supposed ratio of silicon and boron of 2 : 1 are accounted for by the supposition that part of the bivalent group of atoms $=Al—BO_2$ is replaced by the similar groups $=Al—OH$ and $=Al—F$. Room for alternatives still exists, and future investigation may prove a derivation from a complex boro-silicic acid as yet unknown.

Note on a New Meteoric Iron Found near Tombigbee River, in Choctaw and Sumter Counties, Alabama, U. S. A. BY WARREN M. FOOTE. *Am. J. Sci.*, 158, 153–156.—Detailed descriptions are given of the appearance, structure, and occurrence of six masses with an aggregate weight of nearly a hundred pounds. An analysis made by Mr. J. E. Whitfield showed 95 per cent. iron, 4 per cent. nickel, with small amounts of cobalt, phosphorus, carbon, and sulphur.

An Albertite-like Asphalt in the Choctaw Nation, Indian Territory. BY JOSEPH A. TAFF. *Am. J. Sci.*, 158, 219–224.—This asphalt, which is found in several localities in the vicinity of McAllister, in the southeastern portion of the territory, occurs as stringers in veins filling fissures along zones of thrust faulting in shales of unknown age. Although an analysis showed that in composition it was very similar to certain bituminous coals of the same region, its brittleness, easy fusibility, and more especially its distillation products, show that it should be placed among the asphalts. Of these it most nearly resembles albertite, the only important variation being the greater solubility of the latter in terpentine.

On the Separation of Alumina from Molten Magmas, and the Formation of Corundum. BY J. H. PRATT. *Am. J. Sci.*, 158, 227–231.—The evidences bearing upon the separation of alumina from molten magmas as presented in the field by the various types of peridotites of North Carolina are discussed, and an account given of the experiments of Morozewicz and their results. The conclusions are as follows: (1) Corundum will not separate out from a calcium-sodium-potassium silicate magma unless the ratio of alumina to the other bases is more than 1 : 1 and that of silica is less than 6. (2) It will not separate unless more than enough alumina is present to unite with all the magnesia and iron in the magma. (3) All alumina in a magnesium silicate magma, if there is no excess of magnesia, will separate as corundum. (4) If magnesia is in excess, the excess will unite with alumina to form spinel, the remainder separating as corundum. (5) In the presence of chromic oxide in a magnesium silicate magma, slight amounts of alumina and magnesia unite with the chromic oxide to form chromite, but corundum and spinel do not separate. (6) In peridotite magmas containing alkalies or alkali earths a portion of the alumina unites with them to form feldspar. (7) The tendency of alumina to unite with alkalies or alkali earths to form double silicates is strong, but it has little tendency to unite with magnesia when the magma is a magnesium silicate.

Experiments Relative to the Constitution of Pectolite, Pyrophyllite, Calamine and Analcite. BY F. W. CLARKE AND GEORGE STEIGER. *Am. J. Sci.*, 158, 245–257.—The purpose of the examination was to gain evidence of the chemical structure of silicates by means of fractional analyses. 1. Pectolite. The radiated variety from Bergen Hill, N. J., was analyzed, the analysis giving the accepted formula $HNaCa_2Si_3O_9$. To determine whether this represents a true metasilicate, the mineral was ignited and afterwards boiled in a solution of sodium carbonate, with the result that a mean of 8.68 per cent. of silica (the amount proportional to the acid hydrogen) went into solution. Boiling the unignited mineral in the sodium carbonate solution, or even with water alone, resulted in a slow decomposition with loss of both silica and bases. The loss on boiling for 16 hours in distilled water was 4.09 per cent. 2. Pyrophyllite. On strongly igniting and treating with a solution of sodium carbonate, it was found that only 2.84 per cent. of silica was liberated, indicating that the mineral may with propriety be regarded as a basic salt of the acid $H_2Si_2O_5$ with the formula $Si_2O_5{=}Al{-}OH$. Pyrophyllite was only slightly attacked by heating with dry ammonium chloride. 3. Calamine. On igniting no definite fraction of water was split off. Boiling with sodium carbonate dissolved slight amounts of silica and zinc, but no breaking up into definite distinguishable fractions occurred. The evidence, though negative, is in favor of the usual formula $SiO_3=(ZnOH)_2$. 4. Analcite. On ignition and treatment with sodium carbonate solution only a slight amount of silica was split off, indicating the absence of metasilicic acid or an acid metasilicate. On heating with dry ammonium chloride there was again very little silica split off, but half of the sodium was converted to NaCl, and part of the water replaced by NH_3, giving a residue of $H_2Na_2Al_4Si_8O_{24}.NH_3$. This points to the original formula of $Na_4Al_4Si_8O_{24}.4H_2O$, which is contrasted with the usual formula $NaAlSi_2O_6.H_2O$. The conclusion from the probable structural formula is that analcite is a member of the garnet-sodalite group.

The Mineralogical Structure and Chemical Composition of the Trap of Rocky Hill, N. J. BY ALEXANDER HAMILTON PHILLIPS. *Am. J. Sci.*, **158**, 267–285.—Numerous analyses of the trap and of several of the component minerals are given. The trap occurs in the form of a dike and in general appearance resembles a dolerite. In composition, however, it approaches closely to diorite but with border phases allied to diabase.

Some Analyses of Italian Volcanic Rocks. I. BY HENRY S. WASHINGTON. *Am. J. Sci.*, **158**, 286–294.—The analyses of the trachytes of the Phlegraean Fields and Ischia indicate that these volcanic rocks are not genetically related to the closely adjacent rocks of Somma and Vesuvius, but are connected with a second and older fracture line extending from Capraia to Sicily, and covered largely by the waters of the Mediterranean. The rocks of this latter fracture show an excess of Na_2O over K_2O, while in the former K_2O and CaO predominate. A third fracture line, the oldest of the three, occurs far out in the Mediterranean and is characterized by rocks very high in Na_2O and possessing several peculiar sodium minerals.

Mineralogical Notes: Melonite, Coloradoite, Petzite, Hessite. BY W. F. HILLEBRAND. *Am. J. Sci.*, **158**, 295–298.—An analysis of a nickel telluride from the Mother Lode region of California gave the formula $NiTe_2$, and is regarded by the author as probably identical with the melonite (Ni_2Te_3) of Genth, which was obtained from the same locality. Other minerals recognized from this locality were coloradoite, petzite, and hessite. Analyses are given for the last two.

An Account of the Character and Distribution of Maryland Building Stones. By Edward B. Mathews. *Maryland Geol. Surv.*, **2**, 125–241 (1898).—An extended description, accompanied by colored plates, is given of the common building stones, including granite, gneiss, limestone, marble, sandstone, and slate. The descriptions of the more typical varieties are supplemented by analyses.

The Physical, Chemical, and Economic Properties of Building Stones. By George P. Merrill. *Maryland Geol. Surv.*, **2**, 47–123 (1898).—A general description of the building stones of Maryland is given, supplemented by a discussion of the weathering agencies, both chemical and mechanical, and their effects upon the color, strength, and durability of the various stones. The chemical tests used to determine the permanence of color and resistance to corrosion, together with the mechanical tests for determining the absorptive powers, resistance to freezing, resistance to abrasion, crushing strength, etc., are described at some length.

Summary Report of the Geological Survey Department for the Year 1896. By G. M. Dawson. *Geol. Surv. Canada, Ann. Rep.*, **9**, *Rep. A*, 3–144 (1898).—In addition to the accounts of the geological work, the report includes a general description of the work done in the chemical laboratory of the survey upon the waters, fuels, building stones, ores, etc., of Canada.

Report of the Section of Chemistry and Mineralogy. By G. Christian Hoffman. *Geol. Surv. Canada, Ann. Rep.*, **9**, *Rep. R*, 1–53 (1898).—The report includes a large number of analyses of coals, building stones, waters, and minerals, by F. G. Wait and R. A. A. Johnston. Of the minerals, the most noteworthy is that of baddeckite, a new copper-red variety of muscovite, corresponding to the formula

$$H_4(CaMgK_2Na_2)(Fe_2Al_2)_3Si_8O_{28}.$$

The results of some 87 gold and silver assays, and 5 nickel and cobalt assays by Mr. Johnston are also given.

APPARATUS.

A. H. Gill, Reviewer.

An Apparatus to Facilitate Hydrogen Sulphide Precipitations. By R. K. Meade. *J. Am. Chem. Soc.*, **21**, 421.—The gas enters and exits through openings of capillary size, and the absorption is aided by shaking.

A Simple Volumenometer. BY C. E. LINEBARGER. *J. Am. Chem. Soc.*, **21**, 435–437.—The apparatus resembles that of McKenna and possesses the additional advantage that it can be constructed of apparatus occurring in any laboratory.

The Incandescent Lamp as a Source of Heat in Ether Extraction. BY C. G. HOPKINS. *J. Am. Chem. Soc.*, **21**, 645–647.—Five 32-candle-power lamps furnish sufficient heat for twenty sets of Soxhlet extractors.

An Electric Drying Oven. BY T. W. RICHARDS. *Am. Chem. J.*, **22**, 45–49.—The oven itself consists of one large bottomless beaker inside another, both resting upon a tile, which is supported upon layers of asbestos and wire gauze. An inverted clock glass or porcelain dish serves as a cover. The source of heat is 5 m. of platinum wire, 0.2 mm. in diameter, wound upon a reel of glass rods and porcelain bars; a current of 2 amperes (potential of 52 volts) gives heat sufficient to heat the oven 140° above the temperature of the room. To equalize the temperature within the oven a face is placed immediately above the heating coil. The apparatus is safe, easily constructed, and very satisfactory.

A Serviceable Generator for Hydrogen Sulphide. BY W. P. BRADLEY. *Am. Chem. J.*, **21**, 371–376.—The apparatus, which cannot well be understood without the figure, is easily constructed and cared for, and after an experience of nine years is said to leave little to be desired.

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